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REFRIGERATION IN SURGERY OF THE EXTREMITIES

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THIS paper was originally completed as a case report of an unusually severe spreading infection of an arm, in which an unexpectedly favorable outcome followed the employment of a tourniquet and ice refrigeration prior to amputation. Refrigeration proved so gratifying, however, that the members of the Surgical Service at the Salem Hospital were encouraged to employ this form of therapy in several other suitable cases in which trial of this method seemed reasonable.

Broadly speaking, refrigeration therapy has been advocated for three types of surgical lesions of the extremities: arteriosclerosis with circulatory insufficiency, uncontrollable limb sepsis and severe trauma to the limbs with circulatory impairment. Our case total is small, but our experiences have been illuminating. Case reports illustrative of each of these three types of surgical lesions of the extremities are submitted in the order in which they were encountered.

LIMB SEPSIS

The first case was that of a desperately ill and toxic patient who had uncontrollable sepsis in a cold, pulseless arm, with beginning gangrene of the hand.

CASE 1. A 54-year-old leather worker was admitted to the Salem Hospital on December 17, 1942. Because of his toxic condition and language difficulty, no adequate history was obtained at entry, nor was it possible to obtain additional information later on. Apparently, a small break in the skin of the forearm had occurred at work 10 days prior to admission. There was also a questionable history of chrome dermatitis, with some pruritus and scratching. Five days prior to entry the forearm became swollen and the patient resorted to alcohol for relief. He continued at work until the day before entry. He had sought no medical advice prior to admission. On the night of entry the left hand had begun to turn black.

The patient was a strong, middle-aged laborer, rational but unco-operative. The temperature on admission was 102.6°F., the pulse 110, and the respirations 46. The white-cell count was 6100 and the hemoglobin 97 per cent. The blood pressure in the Out Patient Department at entry was 80/54. The left arm and hand were tremendously swollen and cool, and cyanotic to 7 cm. below the level of the shoulder joint. The coldness and cyanosis were progressively more marked as the hand was approached. The superficial layers of the skin over the lower forearm, wrist and hand had sep rated from the deeper layers, and there were multiple, thin-walled vesicles and bullae filled with blood-tinged watery fluid. The radial pulse was not felt, but a brachial pulse was present. The hand was blue to black. The entire arm was extremely painful to touch. The appearance of the arm and the fact that it was a winter night suggested to the house officer an admission diagnosis of frostbite. Routine shock treatment was instituted, and 2 hours after entry a feeble radial pulse could be felt in the affected arm. On the night of entry, treatment consisted of continuous hot packs to the entire left arm and intravenous sodium sulfadiazine.

During the night of admission the systolic blood pressure ranged from 70 to 90. On the following morning the temperature was 103.8°F., the pulse 120, and the respirations 35. Twelve hours after entry, the patient was seen by four senior surgeons. He was extremely noisy and unco-operative and appeared very toxic. The face showed an ashen-gray hue, although the blood pressure was then 118/84. The entire left arm was cyanotic; most of the bullae had ruptured during

FIGURE 1. *Photograph of the Left Lower Forearm and Wrist Fifteen Hours After Admission.*

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the night (Fig. 1); no radial pulse could be felt despite the adequate blood pressure. The sulfadiazine level was 17.6 mg. per 100 cc. There had been no report on the blood culture or on the cultures of the fluid from the bullae. There was an even division of opinion among the consultants concerning the wisdom of immediate amputation, in contrast to a policy of delay with the hope of improvement in the general condition. Opinion was unanimous, however, that whatever course was followed, the patient was almost surely going to die. In this dilemma, application of a tourniquet and refrigeration seemed worthy of trial.

Accordingly, the entire left arm was packed in ice and a tight tourniquet was applied to the upper arm 7 cm. below the shoulder, using three turns of gum-rubber tubing. At that time it was planned to amputate the arm in a few hours,

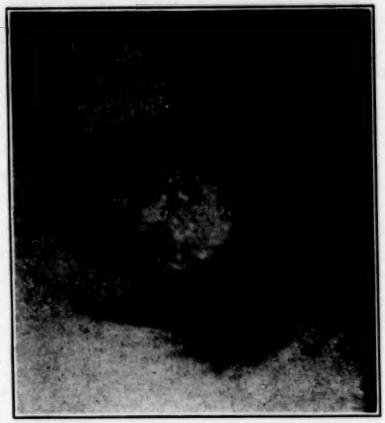

FIGURE 2. *Photograph of the Stump Prior to the Minor Operations.*

but the patient, who was then partly delirious, refused permission. That afternoon the white-cell count was 5400.

On December 19, after 20 hours of tourniquet and refrigeration, there was an obvious dramatic change in the patient's condition and appearance. The temperature had dropped to 100.4°F., the pulse to 110, and the respirations to 20. He was quiet and oriented, had begun to take fluids by mouth, and appeared much less toxic. The skin was dry and warm, and the radial pulse in the opposite wrist improved in quality. By that time the blood culture had shown the presence of a hemolytic *Staphylococcus aureus*. Culture from the bleb fluid had shown the same organism and an anaerobic nonhemolytic streptococcus. Shaved ice had been used for refrigeration, but because an improvised apparatus was used, refrigeration up to the level of the tourniquet was incomplete. Nevertheless there was absolutely no sensation below the level of the tourniquet. Amputation was therefore performed 24 hours after the commencement of refrigeration and 36 hours after entry. Preoperative medication consisted of ¼ gr. of morphine sulfate and 1/150 gr. of scopolamine hydrobromide 1 hour before operation. An additional ¼ gr. of morphine sulfate was administered in the operating room, since the patient was wide awake. Nevertheless, he remained awake throughout the operation.

The operation was performed by Dr. D. S. Clark. The left forearm was prepared and draped. The tourniquet was not removed. A guillotine amputation was then done, with no other anesthesia than refrigeration and the tourniquet. No pus was encountered. The soft tissues were surprisingly firm, glistening and fairly normal in color. The transected muscle bundles had the appearance of well-refrigerated meat. Although the patient was wide awake and talking throughout the operation he did not complain or show signs of discomfort at any time. No sutures were employed.

Thereafter the amputated arm was completely dissected by me. The tissues were edematous, but there was no evidence of any accumulation of pus. All the main arteries and veins were examined but no evidence of thrombosis was present.

The 7-cm. stump of the left arm was not refrigerated postoperatively, which was perhaps a mistake. The patient had a stormy convalescence for 10 days and was persistently disoriented, incontinent and cyanotic. The red-cell count dropped to 2,000,000. Extensive sloughing occurred in the narrow band of tissue below the level of the tourniquet, which had had to be left on for many hours. Surgeons with considerable experience with refrigeration have stated that amputation may be done at almost any level below the tourniquet in those limbs in which amputation is performed within four or five hours of the application of the tourniquet and the commencement of refrigeration. The patient was ambulant 1 week after the operation. Two subsequent minor operations were required to remove protruding bone and to approximate loosely the margins of the wound (Fig. 2).

The patient was discharged on March 1, 2½ months after entry, with the stump of the left upper arm well healed. He was last seen on May 1; he had gained 26 pounds in weight, felt well, and had no symptoms in the stump.

It seems worth while to present this report because the case was such a dramatic demonstration of the value of the application of a tourniquet and refrigeration. It is the conviction of all the senior surgeons that the patient would have died if he had been treated either by immediate surgery or by hopeful delay. The overwhelming toxicity due to sepsis, together with the clear evidence of marked circulatory deficiency in the limb, presumably due to vasospasm and edema, did not augur success for formerly accepted routines of treatment. Toxicity secondary to infection had produced a more or less intractable shock that could not be fully combated. The trauma of anesthesia and operation, added to the already existing shock, would almost certainly have been disastrous. Because of the impaired circulation to the limb, chemotherapy and the natural defenses of the circulation were destined to failure because the effective agent could not be brought to the site of the sepsis in therapeutic concentration. The initial treatment by hot pack was probably harmful, since the patient was in shock and the limb was not capable of a reactive hyperemia because of the vasospasm that was presumably present. Moreover, any increase in blood supply to the affected limb brought about by vasodilatation due to heat must have been more than offset by the accelerated metabolic demand for oxygen on the part of the anoxic tissues. But although an adequate blood supply and effective chemotherapy could not be provided at the local site of infection, it was obvious that toxins and bacteria were being liberated freely into the systemic circulation from the limb.

We asked ourselves whether the limb could be saved by refrigeration and systemic chemotherapy without the use of a tourniquet. Two considerations prevailed against this. In the first place, the cold, cyanotic, pulseless forearm and hand strongly suggested the onset of gangrene, so much so that it was unanimously thought that arterial thrombosis had

occurred because of intimal damage from pressure and sepsis together with peripheral circulatory failure. Moreover, it was apparent that the immediate physiologic amputation of the septic limb by a tightly applied tourniquet was imperative in order to put a quick stop to the continued entrance of bacteria and toxin into the general circulation. Refrigeration alone could not have produced any such an immediate result.

Limb Trauma

Several recent cases of severe limb trauma treated at the Salem Hospital have suggested a number of questions concerning the value of refrigeration in such conditions. The following case is cited as an example.

Case 2. A 9-year-old boy sustained a severe, crushing compound fracture of the right index, middle and ring fingers when a manhole cover fell on them. When he was first seen in the operating room 1¼ hours after the accident, a complete compound fracture with fairly extensive laceration of the adjacent soft parts was found in all three fingers, just inside the proximal interphalangeal joints. Distal to this level of fracture the fingers were slightly cyanotic. It was recognized that there was serious circulatory impairment, but it was decided to be conservative. Accordingly the wounds were thoroughly irrigated with tincture of green soap, followed by saline solution. Minimal sharp debridement was done, the wound was dusted with sulfanilamide, a vaseline dressing was applied, and skeletal traction fixation was secured by pins through the distal phalanx. Continuous refrigeration by shaved ice was employed with only a thin layer of gauze over the wound and with the fingers fixed in elastic-band traction on an arm board.

The arm was then elevated, and more or less continuous refrigeration was maintained for 12 days. No sign of sepsis appeared. During the 1st week the patient repeatedly stated that he was free of pain when his hand had been freshly iced, but that he had considerable discomfort after the ice had melted and until it was renewed. It was not known how long refrigeration should be maintained, but after 1 week the loosely covered hand was exposed to the air without refrigeration for varying periods. During this first week it was hoped that refrigeration was maintaining an equilibrium between the known impaired circulation and the local metabolic demand of the fingertips, reduced by the refrigeration. On several occasions, there appeared to be a suggestive, pinkish suffusion of the distal fingers. Certainly the flesh continued to look healthy and no cyanosis appeared. As the interval without refrigeration was increased, however, it quickly became apparent that we had succeeded only in refrigerating dead tissue so that frank decomposition was forestalled. A few hours after refrigeration was withdrawn altogether, obvious gangrene was readily apparent. Amputation of the three fingers was finally necessitated at the same level at which it would have been done at entry. Convalescence was uneventful.

The chief question that this experience brought to our minds was, For what length of time may one employ refrigeration with continued hope of improvement in such a borderline trauma with circulatory impairment?

Several recent papers assert the value of refrigeration in the management of limb trauma both in civil and in military practice. For the occasional case in which it is indicated, the procedure is simple and deserving of consideration. Even small hospitals can afford the equipment.

Arteriosclerosis with Gangrene

Recently, a splendid opportunity was afforded to make a comparison between refrigeration anesthesia and one of the previously accepted forms of anesthesia, as employed in amputation of limbs for arteriosclerotic gangrene. Within one month an elderly patient was obliged to undergo amputation of both legs through the thigh because of arteriosclerotic gangrene associated with diabetes. For the first amputation, cyclopropane and nitrous oxide anesthesia was satisfactorily employed. More recently the second limb was removed under ice anesthesia together with the usual sedation.

Case 3. A 70-year-old man with mild diabetes mellitus had narrowly escaped amputation of the left leg in the fall of 1942, when he was required to spend 3 months on the surgical ward and to undergo three minor local operations because of a septic blister on a toe. Optimism for such conservative surgical management seemed warranted by the presence of good pulsation of the dorsalis pedis artery and by the ready controlling of the mild diabetes. The patient, however, maintained no satisfactory regime of peripheral vascular hygiene, and in August, 1943, returned with frank gangrene of one of the toes of the right foot. There was no pulsation in this foot. Accordingly, on September 14 a routine midthigh amputation of the right leg was performed under cyclopropane and nitrous oxide anesthesia, which was quite satisfactory. Ordinarily spinal anesthesia would have been employed. Refrigeration anesthesia had been mentioned as a possibility. The operation required 35 minutes. The stump was dusted with sulfanilamide powder and closed without drainage. One hour later the patient complained of considerable pain in the leg. Three hours later, a preoperative blood pressure of 132/66 had dropped to 102/60. The patient was nauseated and showed signs of mild shock, for which elevation of the foot of the bed, warm blankets and Neo-Synephrine were employed.

The temperature first returned to normal on the 5th postoperative day. The patient did not get out of bed until the 7th day. He experienced the usual amount of postoperative pain. The stump dressing showed staining and required reinforcement several times in the first 36 hours. Healing was uneventful except for several areas of protracted healing of skin edges. The level of blood sugar was controlled with a little difficulty.

During the next 3 weeks, the tips of two toes on the left foot steadily became discolored. In addition, superficial sepsis at the site of a thickened callus at the base of the little toe progressed to involve the deeper tissues and eventuated into a chronic ulcer with an associated x-ray finding of complete destruction of the head of the 5th metatarsal bone. It was assumed that a Mönckeberg type of sclerosis of the small vessels existed, coincident with the diabetes, since satisfactory pulsation of the dorsalis pedis artery could be felt. During this period of waiting it was difficult to prevent those on the ward having care of the patient from employing heat from 100-watt bulbs directly over the weeping ulcer with the aim of drying up the lesion.

Finally, on October 18, the second limb was amputated through the thigh. Preliminary sedation was secured with Pantopon, scopolamine and 2 ounces of whisky. A 6-hour period of cracked-ice refrigeration was employed. A supracondylar amputation was done, since it was thought that less shock would attend tissue trauma through the tendons at this level than through the muscle masses at midthigh.* Thirty-five minutes was consumed in performing the operation. The patient grimaced when the sciatic nerve was crushed and cut across. It was thereafter injected with 3 cc. of absolute alcohol. Otherwise, he felt no pain. No chemotherapy was employed. A single layer of sutures approximated the muscle group.

The patient sat up in bed and ate lunch 1 hour after the completion of operation. He sat up in a chair that afternoon and every day thereafter. He did not go into shock, as was the case after the first operation. The postoperative pain was about the same as after the first operation. The temperature became normal on the 4th postoperative day. The

*Amputations below the knee in occlusive arterial disease have recently been proposed by Bickel and Ghormley,[1] in cases in which adequate circulation at this level justifies the procedure. They argue that the chance for a later satisfactory prosthesis is appreciably greater than if the usual midthigh amputation is done.

dressing showed no staining, in contrast to the first amputation. Nausea and vomiting, however, were a little more pronounced after this operation than after the first, possibly because of the release of the tourniquet just prior to amputation. (It has been argued that premature release of a tourniquet may be productive of shock, due to absorption of histotoxins, in patients in whom widespread sepsis or severe tissue trauma exists.) The diabetes showed about the same reaction to this second amputation as to the first. Wound healing progressed uneventfully.

This case demonstrated that it is possible to secure satisfactory anesthesia by ice refrigeration. The mechanics of such anesthesia proved to be more of a chore than is the case with the usual low-spinal anesthesia. It is the impression of several surgical observers that the postoperative convalescence after the second amputation using refrigeration anesthesia was definitely more satisfactory than that after the first operation but the percentage of improvement was perhaps a small return for the additional work required. Hence, we are not yet willing to resort to this cumbersome procedure for anesthesia as a routine for all amputations in arteriosclerotic gangrene. We have been convinced that satisfactory anesthesia can be secured by the method, and that there are occasional cases in which its employment provides the most satisfactory solution to the problems of securing anesthesia and minimizing systemic reaction to surgery of the extremities.

Discussion

Clinical use of the principle of refrigeration of limbs is concerned almost exclusively with those limbs in which efficient circulation does not exist. Following the pioneer lead of Fay,[3] Allen[3-7] elaborated on the principle of refrigeration. Thereafter Smith,[8] McCravey,[9] and Whittemore, Lisa and Sauer,[10] made further contributions. From Allen's experimental observations on tissue asphyxia in relation to the temperature of the environment, he was prompted to study the survival time of tissues with inadequate blood supply when exposed to heat and to cold. Heat accelerated necrosis, whereas cold markedly prolonged the survival time of anemic tissues. Oxygen consumption of the tissues is reduced progressively for each degree Centigrade by which tissue temperature is lowered. Allen made the first clinical application of laboratory observation in cases of arteriosclerotic gangrene of the leg. Subsequently, the value of refrigeration in arteriosclerotic gangrene and in limb sepsis and trauma has been repeatedly confirmed by Allen and all other observers[11-17] who have made the clinical trial. It is worthy of repeated emphasis that the essential feature in all these cases has been a deficient circulation to the limb. Very few observers have claimed any merit for refrigeration when normal circulation is present. Conditions of trauma or of sepsis can be better handled by the tissues with the aid of their normal physiologic inflammatory reaction than by suppression of this reaction by refrigeration. The assets of this normal inflammatory response are increased exudate, increased absorption and increased local heating of tissues with accelerated tissue metabolism. At the same time there is a greatly increased tissue demand for oxygen, out of proportion to the increased local blood flow. In a limb with deficient circulation, a disparity may exist between the supply and the demand for oxygen on the part of the tissue cells; hence, necrosis of tissue may occur if an inflammatory response is provoked. The refrigeration of such tissues is beneficial because it retards the oxygen demand of the tissues to a level commensurate with the available oxygen brought to the limb by the deficient circulation. This metabolic adaptation is apparently the principal benefit resulting from refrigeration, but there are a number of other advantages emphasized by Allen and confirmed by almost all investigators, as follows. First, there is efficient anesthesia, secured by the action of refrigeration on nerve trunks and also by what Allen terms "anesthesia of protoplasm." Second, anesthesia of protoplasm, in contrast to nerve anesthesia, is said to be a factor in preventing shock; shock is also lessened by the diminished tissue necrosis, diminished bacterial growth and the diminished absorption from the local site because of the vasoconstriction brought about by refrigeration. Third, local infection and edema are inhibited. This is in line with the familiar preservation of tissues in an icebox for days or weeks. Fourth, desired drainage from an amputation stump for the first few postoperative days is facilitated, because cooling of the tissues prevents the usual agglutination of the wound edges. Thus, postoperative sepsis in the stump is minimized. Lastly, the tendency to thrombosis and intimal damage of blood vessels is greatly lessened. Venous thrombosis in amputated stumps has recently been emphasized by Veal[18] as a frequent cause of postoperative fatality, owing to subsequent embolism.

It has been demonstrated by experimental and clinical experience that all the above benefits may be conferred on patients, in varying degrees, by the process of refrigeration alone, except that anesthesia is not so complete. In clinical practice, however, refrigeration and a tightly applied tourniquet are usually employed, except in occasional cases where a reasonable hope of survival of the affected limb exists. Even in this situation a tourniquet may be applied to the refrigerated limb for some hours and perhaps several days, without compelling amputation because of necrosis distal to the tourniquet. It is necessary, therefore, to give some consideration to the role that the tourniquet plays in the improvement of the patient's condition. First, toxic absorption from a hopelessly traumatized limb or a septic limb is controlled. The tourniquet also plays a significant role in the control of shock resulting from a septic or traumatized limb, as shown in recent studies by Duncan and Blalock.[19] Lastly, the boon of adequate anesthesia by refrigeration is often lost

unless a tightly applied tourniquet has completely shut off available circulation, since successful chilling of tissues is directly proportioned to the degree of reduced blood flow. In our reported case of sepsis there can be no question that the immediate physiologic amputation of the septic limb by a tight tourniquet was highly useful in the control of toxic and septic absorption.

Technic

The essential points of technic with tourniquet and refrigeration have been fairly well established. The refrigeration of limbs has been secured by shaved ice, ice water, or electric or gas refrigeration units.

FIGURE 3. *Photograph of the Refrigeration Box.*

A common device is to employ a rectangular box into which the affected limb can be placed, and then surrounded by ice. We secured a refrigeration box modeled after the one proposed by Gordon[20] (Fig. 3). Preliminary refrigeration by ice bags at the level of application of the tourniquet will suffice after a few minutes to permit a tight application of narrow gum-rubber tubing applied several times around the limb. Allen[21] states that a narrow tourniquet is more satisfactory than a broad one. Incomplete anesthesia may result if the tourniquet is not tightly applied, since it will be more difficult to refrigerate the tissue. The limb must be refrigerated to the level of the tourniquet. The desired level of temperature is about 5°C. which will effectively chill the tissues without actually freezing them. Lake[22] has found that at a temperature of −6°C. all metabolic processes are inhibited. Therefore the thermal level of refrigeration is important, since actual freezing causes irreparable tissue damage, with the loss of large amounts of protein fluid at the site.[23] If saving the refrigerated limb is contemplated, actual freezing must be guarded against by skin-temperature readings. The temperature of the limb immersed in ice may be recorded by thermostat or by simple thermometers held against it. In a patient in good general condition, amputation through the lower thigh may be done with complete refrigeration anesthesia after two and a half hours. Amputation just below the knee requires about two hours for satisfactory anesthesia. A progressively shorter time is required as one approaches the foot because of the diminished mass of the limb and the increased ease of thorough chilling. If the amputation is done within six hours of the application of the tourniquet, almost any level of amputation distal to the tourniquet may be selected with confidence that healing will occur. If the tourniquet is to be left on longer than six hours, it should not be removed prior to operation, since overwhelming shock or generalized sepsis may result from its premature release.[9] When a tourniquet has been left on for longer than six hours, amputation must be done at or within a few inches of the level of the tourniquet. Refrigeration greatly prolongs the safe period during which a tight tourniquet may be applied. Hence it is suggested that refrigeration is adaptable to wartime injuries of the extremities because it lengthens the safe period of tourniquet application and provides complete anesthesia for later surgery.[24] In poor risk patients, the tourniquet may be left on for as long as two days while the general condition is being improved. Preliminary sedation may be administered prior to the operation, but oftentimes it is unnecessary. Whiskey is a good sedative for elderly arteriosclerotic patients.

It is a common experience to obtain complete anesthesia by refrigeration and tourniquet only, without the use of any other agents. The two procedures that test the adequacy of refrigeration anesthesia are the cutting of the sciatic nerve at midthigh and the sawing of the femur. Following operation, it has been recommended by Allen[10] that refrigeration of the stump be maintained by means of ice bags against a thin dressing, gradually reducing the refrigeration over a period of several days. A number of writers[13, 14] have commented on the fact that elderly, poor-risk patients are able to return to their rooms, sit up out of bed on the day of operation, and eat their meals, in contrast to the usual weakness and depression of similar patients who have received spinal anesthesia for leg amputation. Wound healing is steady, although slower, with refrigeration. Stump sepsis is said to be lessened, presumably on the basis that postoperative wound drainage is usually more profuse, since the refrigeration inhibits the normal agglutination of the wound margins. Haley[13] comments that a rise in

postoperative temperature after an amputation done under refrigeration anesthesia is not so prolonged as after amputation under spinal anesthesia.

Indications for Use

Arteriosclerotic gangrene. This has been the most frequent lesion in which refrigeration anesthesia has been used. Two distinct types of cases have been treated. When amputation is inevitable in nontoxic patients in poor general condition, the application of a tourniquet and refrigeration have provided a quick, satisfactory anesthesia within several hours, accompanied by minimal reaction to the operative procedure. On the other hand, if spreading sepsis predominates in the arteriosclerotic limb, permanent and continuous refrigeration may be employed for a period of days while the general condition is being improved.

Sepsis. Cases similar to the one reported in which a previously normal limb is the site of uncontrollable sepsis have been infrequently reported. Refrigeration appears to be efficacious in forestalling the spread of sepsis.

Military wounds. Allen and Crossman[21] have stated that tourniquet refrigeration provides freedom from pain, hemorrhage, shock and infection and allows either an immediate operation without other anesthesia or long deferment of operation without harm, if such a step is indicated. They emphasize that the safe period for the application of the tourniquet is greatly lengthened by refrigeration. They point out that refrigeration is usually available on naval vessels, and that a 200-pound apparatus that can be operated by the motor of a truck will refrigerate four to six limbs simultaneously. Bowers[25] has related favorable experiences in the treatment of cases of vascular trauma of the extremities encountered in a station hospital (Camp Gruber, Oklahoma). He found the fluorescein circulation-time test to be of value in the estimation of circulatory adequacy in refrigerated limbs. Criteria of failure of compensatory collateral circulation are listed.

Miscellaneous. Holman[26] suggests that in cases of limb trauma accompanied by concussion of the main artery with subsequent segmental arterial spasm, initial refrigeration enhances the survival of such a limb. In the immersion-foot syndrome, the principle of refrigeration has been employed to provide therapeutic cooling of hyperemic painful feet during the early stages.[27, 28] Such cooling without actual refrigeration is also useful in cases of frostbite, and we have recently treated a patient with moderately severe frostbite in this manner. Mock[29] has successfully employed refrigeration anesthesia for the taking of skin grafts from the thigh.

Summary

The principle of refrigeration has been established as a useful and at times lifesaving procedure in the management of arteriosclerotic limbs with gangrene. A case is cited in which refrigeration anesthesia is favorably compared with general anesthesia.

Refrigeration may also be employed successfully in certain cases of trauma or sepsis of the limbs. A case is reported in which it is suggested that life was saved by the employment of refrigeration and a tourniquet.

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AN ERUPTIVE FEVER INVOLVING THE MOUTH AND EYES (STEVENS-JOHNSON'S DISEASE)*

Report of a Case

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IN 1922, "a new eruptive fever associated with stomatitis and ophthalmia" was reported by Stevens and Johnson.[1] A score of similar cases have since been added to the literature, all with unwieldy names, such as "erythema multiforme bullosum with involvement of the mucous membranes of the eyes and mouth."[2] No suitable name has been proposed for this disease, which appears, as cases accumulate, to merit recognition as a discrete syndrome. It is a bizarre disease of dramatic onset and course, and there are so many features common to each reported case that it seems justifiable to separate them from erythema multiforme and other established entities of this order.

This disease is one of acute, sometimes fulminating, systemic reaction with fever and prostration, erythematous generalized skin rash and severe stomatitis, followed by sloughing. With occasional exceptions[3] the conjunctivas are involved. The usual period until resolution of the skin lesions is about three weeks.[2] All laboratory studies have revealed normal or variable findings, including blood-cell counts, blood cultures,[4] smears and cultures of lesions,[4, 5] a skin biopsy[4] and studies of the chemical constituents of the blood.[4] The suggestion that Vincent's stomatitis may be associated etiologically with the disease[5] has not been confirmed.[2]

The following case is reported because it illustrates clearly the most constant clinical findings of this disease.

CASE REPORT

J. M., a 22-year-old, unmarried man of Italian parentage, was admitted to St. Luke's Hospital on February 5, 1943, complaining of blisters in his mouth that had first appeared 2 days before admission, and had progressed since that time. He had had no previous illnesses, and had enjoyed excellent health except for a moderate tendency to upper respiratory infections. He had had a cough and mild malaise an the 2 weeks previous to admission. He had recently used an elixir of terpene hydrate and codeine, and had taken a few tablets compounded of aspirin, acetphenetidin and caffeine, but no other drugs. He had also gargled with a strong solution of sodium chloride. The present illness began 3 days before admission with a swelling between the upper lip and gum, where the patient noticed burning on taking food. Later blisters began to appear on the buccal mucous membrane.

Physical examination showed a well-developed and well-nourished, swarthy-skinned man who appeared comfortable. The temperature was 101° F., the pulse 120, and the blood pressure 112/76. The conjunctivas were diffusely inflamed. The buccal mucous membrane, gums, palate and uvula were covered with many tight vesicles the size, shape and color of medium-sized pearls. There was also a small amount of red inflammatory reaction and sticky exudate about the urethral meatus. The rest of the examination was negative.

Routine laboratory studies showed a normal chest film and electrocardiogram. The urea nitrogen was normal, and a blood serologic test for syphilis was negative. The red-cell sedimentation rate was slightly elevated (33 mm. per hour), which may have been caused by the respiratory infection.

The patient remained in the hospital for 17 days. During the first 2 days the disease ran an alarming, fulminating course. The temperature rose rapidly, and for the first 3 days ran a hectic course, up to 104.6° F. The mouth lesions progressed with striking speed during this time. All the pearl-like vesicles in the mouth quickly ruptured, leaving a loose, dirty, whitish slough. By the 3rd day there was a massive slough several millimeters deep affecting the entire mucous membrane of the mouth and sparing only the tongue, which was heavily coated. This process extended out over the lips almost to the vermilion border. The surface thus uncovered was raw and angry red, and bled easily when touched. The nasal mucous membrane sloughed in the same, though a less dramatic, manner. Large blebs appeared on the glans penis and one on the corona, both also with superficial sloughs. Both conjunctivas were markedly inflamed, but no vesicles formed about the eyes. A sticky, semipurulent exudate flowed continually from the eyes. On the arms and legs a few punctate red areas began to appear and expanded, and in the center of each a tight little vesicle appeared. These vesicles ripened into thin-walled bullas, and eventually ruptured. They were scattered over all four extremities, but spared the trunk and face.

On the 5th day the temperature fell and the patient began to improve. He continued to recover gradually, although the sloughs in the mouth and on the penis were not complete before the 3rd week. Photographs taken on the day before discharge (the 16th day) show the residuums on the lips (Fig. 1), buccal mucous membrane (Fig. 2), legs (Fig. 3) and penis (Fig. 4).

The blood on admission showed normal red elements and a white-cell count of 13,000, with 70 per cent neutrophilic polymorphonuclear leukocytes and 6 per cent eosinophils. The latter figure and the white-cell count as a whole gradually fell to normal. Blood cultures and aspiration cultures of the bullas were sterile. A conjunctival culture yielded *Staphylococcus aureus*. Smears of the bullas were negative both for eosinophilic polymorphonuclear leukocytes and for organisms. No significant evidence of the common heavy metals was found on qualitative tests of two 24-hour urine specimens.

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The patient had had a mercury-amalgam tooth filling 1½ months previously, but no other significant metal or drug

FIGURE 1. *Late Lesions on the Lips.*

history could be elicited from either the patient or his dentist.

The therapeutic measures employed included sulfadiazine in full doses for 5 days, the forcing of fluids, colonic irrigations, calcium gluconate intravenously and numerous salves,

FIGURE 2. *Re-epithelialization of the Lesions of the Buccal Mucous Membrane.*

washes and other local applications to the mouth, penis and eyes.

At the end of 17 days the skin lesions had crusted and mostly fallen away with healing beneath, and before the end of the 4th week the scars were barely visible.

DISCUSSION

Stevens and Johnson[1] outlined most of the features of this disease with their "two cases of an extraordinary, generalized, eruption with continued fever, inflamed buccal mucosa and severe purulent conjunctivitis." Although the skin lesions of these cases were not vesicular or bullous as in the present case and numerous others,[2-4, 6] the appearance of the buccal mucosa was almost identical, with the formation of tight vesicles that ruptured and progressed rapidly to a membranous slough. The exact appearance of the skin lesions, in fact, appears to vary somewhat in different cases, and Stevens and Johnson even repudiated as inadequate the diagnosis

FIGURE 3. *Late Lesions on the Right Leg.*

of erythema multiforme. The reaction of the buccal mucous membrane is more characteristic. Ginandes's[4] description of the mouth lesions corresponds exactly with the picture presented on about the fourth hospital day, in the case above: "The entire buccal mucosa was red, ulcerated in spots and covered with a whitish pseudomembrane which was friable and appeared like ruptured bullas. These lesions varied in size and were surrounded by a zone of marked congestion. The hard and soft palates were diffusely mottled and similarly covered with greyish-white patches." In almost every case in the literature[1, 2, 4-6] the conjunctivas were inflamed and produced a sticky, purulent exudate, as in the case

herein described. The most serious sequela reported was panophthalmitis and total destruction of the eyes, in one of Stevens and Johnson's patients. This complication is said to have occurred in several other cases.[2] There is only one previous report of

FIGURE 4. *Late Lesions on the Glans Penis and Corona.*

penile lesions,[6] although Ageloff[2] described massive vaginal involvement in a four-year-old girl.

The disease is definitely in the pediatric sphere, rare exceptions being the case reported and that of Levy.[3] The age limits are said to be twenty-two months and sixteen years.[2] With rare exceptions,[2] the condition is found only in male children.

SUMMARY AND CONCLUSIONS

A case is presented that is typical of a growing number of cases being reported in the literature, known by such names as "erythema multiforme bullosum with involvement of the mucous membranes." This is one of a number of obviously unsatisfactory names, since it is unwieldy, the disease is not typical of erythema multiforme, and it is the enanthem rather than the exanthem that seems to be its constant feature. The condition begins with a violent constitutional reaction with fever of abrupt onset and with marked prostration. A vesicular stomatitis develops, the vesicles rapidly burst, and a membranous slough forms that leaves a raw buccal and palatal surface behind it. There is almost invariably a diffuse conjunctivitis with a sticky, purulent exudate. This last feature may predispose to the most serious complication of the disease — panophthalmitis and permanent destruction of the eyeballs and therefore constitutes, at the present stage of knowledge, the major point of therapeutic or prophylactic departure.

Nothing is known of the fundamental nature of the disease or of its etiology. Neither drugs nor Vincent's organisms have been implicated, and no other factor of importance has even been suggested. The greatest progress to date is the recognition of the syndrome in its own right, by virtue of several isolated reports describing a closely similar picture.

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PULMONARY ACTINOMYCOSIS

Treatment with Sulfonamides

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PULMONARY actinomycosis is uncommon. At the Johns Hopkins Hospital only one case was found in 12,000 consecutive autopsies.[1] The prognosis is poor and most cases end fatally.[1-5]

The treatment of actinomycosis has in general been unsatisfactory. Iodine is the time-honored weapon against this fungus infection, but thymol, roentgen rays, a variety of vaccines and recently sulfonamides have been used. Masson[6] reported clinical cures in 2 cases of abdominal actinomycosis by roentgen-ray therapy, but, as a rule, roentgen-ray treatments are only partially effective or totally ineffective. Neuber[7] advocated "specific" vaccines, convalescent serums and autohemotherapy, but his practically 100 per cent cures still lack confirmation.

Several recent reports have stressed the effectiveness of the sulfonamides even when other treatments were at best of only slight benefit. In a case of abdominal actinomycosis, Walker[8] reported healing three weeks after sulfanilamide was begun and after iodides had apparently proved of no value. Miller and Fell[9] tried thymol, potassium iodide and roentgen rays, but their patient became progressively worse. Sulfanilamide therapy was instituted and improvement was noted in one week.

Sulfanilamide has also been used in pulmonary actinomycosis. Morton[4] reviewed a case that failed to improve with 400 gr. of potassium iodide daily and roentgen-ray treatments. He stated that sulfanilamide and promin made a definite improvement in the general condition, whereas potassium iodide, even in massive doses, was of only moderate value. Of several different treatments used by Dobson, Holman and Cutting,[10] sulfanilamide seemed to be the most effective therapeutic agent. Wilkinson[11] also obtained good results with sulfanilamide and recommended that it be given for several weeks, if necessary. Temporary benefit was obtained by Schneider and Finucane,[5] but their patient died of complications resulting from pneumothorax and not from actinomycosis.

Sulfapyridine has been employed effectively in both abdominal and pulmonary actinomycosis. Ogilvie[11] treated a young girl with abdominal actinomycosis by massive doses of potassium iodide, but she failed to improve. Sulfapyridine was then given and the response was so favorable that the drug was discontinued in thirteen days. Mitchell[12] tried tincture of iodine and oral actinomycotic vaccine, with no success. Sulfapyridine brought about prompt healing of sinuses and apparent clinical cure.

The following case of pulmonary actinomycosis is reported not only because of the rarity and seriousness of this disease, but more especially because sulfonamides appeared to be of considerable therapeutic value.

CASE REPORT

T. M. C. a 29-year-old housewife, was first admitted on September 4, 1940, after a chest roentgenogram, taken because of a tuberculous husband, had revealed tuberculosis. The past history disclosed incision of the cervical lymph nodes in 1930 and pleurisy 4 months before admission.

Physical examination was essentially negative except for a scar on the right side of the neck and fine rales in the left axilla. A roentgenogram showed areas of increased density in both lungs at the level of the first anterior intercostal space. The urine was negative. Blood examination revealed slight anemia. The sedimentation rate was increased. A Mantoux test was positive. The sputum was negative for tubercle bacilli, but a gastric specimen was positive by guinea-pig inoculation. On November 11, the patient left the hospital against advice.

On April 1, 1942, the patient was readmitted because of pain and swelling in the left chest wall, fever and marked loss of weight. One and a half months before re-entry she had gone to another hospital because of a pain in the left chest of 1 month's duration. While there, the left pleural cavity was incised and 2 cc. of thick pus was obtained. On re-entry, the patient appeared extremely ill, thin and pale. A 2-cm. scar was present just below the inferior angle of the left scapula, and a fluctuant hot swelling extended from this point downward to the tenth rib. A roentgenogram of the chest showed a density consistent with fluid in the left intrapleural space and fibrosis in the left first intercostal space. The temperature was 101° F., the pulse 140, and the respirations 28. The urine was negative. The red-cell count was 3,900,000 the hemoglobin 76 per cent, and the white-cell count 10,500. A blood Hinton test was negative. The sputum and gastric contents were negative for tubercle bacilli by concentration and guinea-pig inoculation.

The day following admission, 2cc. of thick pus was obtained by aspiration of the chest abscess. This pus proved negative for tubercle bacilli by smear, culture and guinea-pig inoculation, but a smear and culture showed *Actinomyces hominis*. Aspiration was repeated on April 10, and 150 cc. of pus containing numerous sulfur granules was obtained. Within the next 2 weeks four sinuses developed at the site of the abscess. In May the patient developed a productive cough, and sulfur granules were found in the sputum. Potassium iodide was begun on May 1 and the dosage was gradually increased to 3 gm. daily.

Abscesses and sinuses then began to appear on the left anterior chest wall and the general condition became worse. On May 22, the patient's name was placed on the danger list. The red-cell count was 3,500,000, the hemoglobin 66 per cent, and the white-cell count 22,000, with 86 per cent neutrophils, 7 per cent lymphocytes, 4 per cent monocytes and 3 per cent eosinophils. Sulfanilamide (6 gm.) was given that day. The next day the dose was reduced to 4 gm. From May 24 to June 12 the patient received 3 gm. daily. Abscesses were aspirated on two additional occasions in May and June. Actinomycotic sulfur granules were still present. The patient improved clinically, however, and on June 6 potassium iodide was discontinued. On June 25, her name was removed from the danger list.

The patient's condition during July appeared stationary. Six chest sinuses were still draining. Sulfanilamide (4 gm.

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daily) was resumed on July 23 and continued until August 15, when sulfathiazole was substituted. This was not tolerated and was discontinued after 2 days. Potassium iodide (2 gm. daily) had been resumed on July 23, and the dosage was gradually increased so that by August 29 the patient was receiving 9.3 gm. daily. Iodides were discontinued on September 13 because of a rash on the chin, but were resumed in gradually increasing doses so that by October 1 10.6 gm. daily was being given. The iodides were continued during the remainder of the hospitalization.

The temperature and pulse showed small but almost daily elevations during the summer, and soreness in the left chest was again noted. Sulfadiazine (4 gm. daily) was begun on September 12. Drainage from the sinuses decreased, and

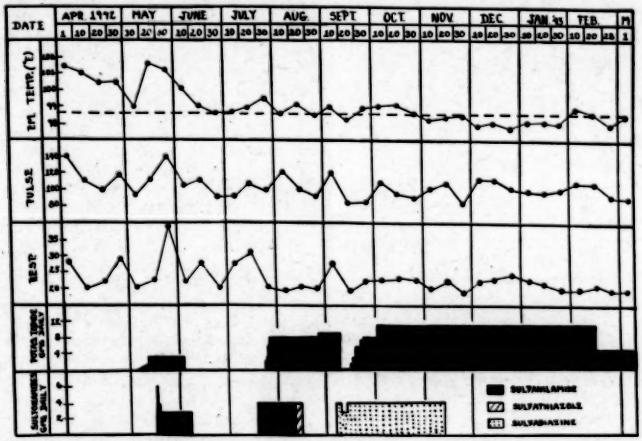

FIGURE 1. *General Trends of Temperature, Pulse and Respirations, with Accompanying Therapy.*

improvement in the general condition was so remarkable that sulfadiazine was discontinued on November 16.

In addition to the sulfonamides and iodides, the patient received ferrous sulfate for her anemia and vitamins to supplement the diet. Blood-cell counts and urine examinations were made almost daily, and blood-sulfonamide levels were determined at frequent intervals. The patient continued to improve and the sinuses discharged less until all but one appeared entirely healed. She was gradually allowed out of bed, and on March 1, 1943, she was discharged.

Figure 1 shows the general trends of the temperature, pulse and respirations during the entire period of illness, as well as the therapy.

At a follow-up examination on January 8, 1944, the patient felt well and had gained fourteen pounds. She denied cough, expectoration or pain. The sinuses had been dry for more than 6 months, and she had been working for 4 months. She was continuing to take 5.3 gm. of potassium iodide daily. A chest roentgenogram was essentially negative except for an area of density in the left base that was apparently due to thickened pleura.

Discussion

Because of its rarity, the diagnosis of pulmonary actinomycosis is frequently missed. Sulfur granules are not always present in the sputum or in the pleural exudate, and even when they are they may not be evident on casual inspection. One must not assume that a chest abscess or empyema is due to tuberculosis merely because the common pyogenic organisms cannot be found in the pus. Even in a case such as the present one, where there was a proved antecedent history of tuberculosis, a search should be made for fungi as well as tubercle bacilli and pyogenic bacteria.

Since 1938 at least 5 cases of pulmonary actinomycosis have been reported in which arrest or cure of the disease has been attributed largely, if not wholly, to sulfonamide therapy. The impression gained from a study of the case reported in this article is that improvement and recovery were definitely enhanced, if not actually brought about, by the use of sulfonamides. Since iodides were also given almost throughout the hospital stay, it is impossible to offer incontestable proof that the sulfonamides alone were responsible for the patient's recovery.

Because iodides in massive doses have been so long regarded as an aid in the treatment of actinomycosis, there is a natural reluctance to abandon them entirely for newer methods of treatment. If iodides are of value at all, their worth is augmented by sulfonamides. It appears likely, however, that sulfonamides are more effective than iodides and may soon replace them entirely in the therapy of actinomycosis.

An interesting side light on this case is that the patient, who had a proved history of tuberculosis, received more than 1800 gm. of potassium iodide in a period of seven months without any evidence of reactivation of the tuberculosis. In an arrested case of tuberculosis iodine should apparently not

be withheld for fear of activation of the disease if indications for its use exist.

Summary and Conclusion

A case of pulmonary actinomycosis, in a patient with arrested pulmonary tuberculosis, is reported in which the sulfonamides apparently resulted in a cure.

The sulfonamides appear to be a valuable aid in the treatment of pulmonary actinomycosis, if not actually a specific cure. Iodides seem to be of less value than either sulfanilamide or sulfadiazine.

After this article had been submitted for publication, 2 cases of actinomycosis were reported in which sulfadiazine was the only medication employed.[14, 15] In both, apparent cure of the disease was attributed to the sulfadiazine.

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MEDICAL PROGRESS

ABDOMINAL SURGERY

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RECENT advances in the field of abdominal surgery are numerous. They will be reviewed under a general heading and under others according to the involved viscus.

General Considerations

Anesthesia

The use of barbiturates in conjunction with other forms of anesthesia has been a popular development. Preliminary sedation has gradually changed from the morphine-and-scopolamine method toward more reliable and safer drugs. Avertin is being used much less extensively than heretofore, since other agents have proved to be more satisfactory.

In an attempt to determine the value of barbiturates in the reduction or delaying of shock under conditions of trauma similar to war wounds, Beecher, McCarrell and Evans[1] have reported the results of their experiments. In anesthetized animals, barbiturates delay shock from trauma producing dehydration or plasma loss, but not shock from hemorrhage. These authors further state that up to the time of the publication of their paper there were no data available to support the theory that barbiturates delay shock in the unanesthetized patient.

Anderson, Mousel and Mayo[2] have compared a group of patients operated on for lesions of the colon by two methods of supplementing spinal anesthesia. When supplementary inhalation anesthesia was used, three times as many patients vomited and there was a 12 per cent mortality rate, whereas in a similar group of patients given a 2.5 per cent solution of Pentothal Sodium intravenously and 100 per cent oxygen by inhalation, only 5 per cent died. The average total amount of Pentothal Sodium given was slightly less than 1 gm. Quick recovery from anesthesia and absence of nausea were believed to play a distinct role in the better results.

This method has been used with and without oxygen at the Massachusetts General Hospital, and there seems to be little difference in the results unless the patient is nauseated early in the procedure. When this occurs, the addition of oxygen is of great benefit. It is probable that the total dose of Pentothal Sodium can be reduced by the use of oxygen, and also that there is a more rapid elimination of the drug. It is extremely desirable to prevent actual vomiting, since inspiration pneumonitis must be avoided. Oxygen inhalation appears to be harmless and probably should be used routinely in this combination.

Transverse Incisions

Transverse incisions are championed by Rees and Coller.[3] They compare 225 patients operated on for abdominal lesions through transverse incisions with 346 in whom the vertical approach was used. Pulmonary complications occurred in 9.5 per cent of the transverse group, as compared with 26 per cent in the vertical. The incidence of dehiscence

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and hernia in scar was markedly less in the transverse group. These writers stress a great diminution in postoperative pain and discomfort. They state that Baudelocque[4] advocated the transverse approach nearly one hundred and twenty-five years ago, and used it in cesarean section.

Since Pfannenstiel,[5] in 1900, advocated a transverse approach to pelvic surgery, there have been numerous advocates of some modification of the method to the abdominal cavity in general. Singleton and Blocker[6] made an exhaustive study of the anatomical approaches to abdominal viscera in relation to wound disruption. Although their incisions were not quite what is interpreted as transverse, they were intended to accomplish much the same purpose. Gurd[7] has strongly advocated the transverse approach to the exclusion of all others. Farr[8] has also contributed much to the subject.

The use of transverse incisions has been adopted in some clinics with considerable regularity, whereas in others it has been used sporadically. At the Massachusetts General Hospital it is believed that many lesions are more easily handled through this approach. There are many patients whose wide-flaring costal angle make a transverse incision desirable for lesions of the upper abdomen. In the patient with a narrow, elongated costal angle, better exposure to the upper regions of the abdomen can be obtained through a long paramedian incision. With the use of nonabsorbable suture material, careful avoidance of nerve damage, absence of drainage through the wound, proper closure and the elimination of postoperative distention and vomiting, there will be less choice between the two methods.

Intestinal Trauma

Intestinal trauma during laparotomy has been properly condemned by Martland.[9] He found the imprints of forceps, used by the surgeon in returning the small intestine to the abdominal cavity, at autopsy in 2 cases. In one case, 1500 cc. of blood that had come from such injuries was found in the lumen of the bowel. In another, he found more than forty of these imprints on the small bowel. In both cases, the surgeon had used a form of intestinal forceps devised for other purposes. They were of the kind that take a wide bite in the intestinal wall, producing a crushing defect that destroys the mucosa and submucosa. Such instruments are of little value for any purpose in intestinal surgery, and should never be used to grasp a segment of bowel that is not to be resected. Since instruments of this type are available, the only safe dictum seems to be to use no instrument in handling the intestine either during exploration or in returning the bowel to its natural position. Better anesthesia and the proper use of gloved hand and abdominal retractors will eliminate the need of a more traumatizing technic.

Drainage of Peritoneal Cavity

Drainage of the peritoneal cavity has been criticized by Cutler.[10] It is amazing that there is still fixed in the minds of many surgeons the belief that the peritoneal cavity can be drained. When there is widespread abnormal fluid within the abdomen, it must be realized that adequate drainage to the outside is almost impossible to establish. The temptation is too great to resist, however, and is apt to lead to the establishment of some variety of foreign body from the depth of the cavity to the periphery. That a certain amount of the fluid contents surrounding the intestines can be led off for a short period of time is acknowledged. That these so-called "drains" not only fail to reduce the incidence of residual abscess but are an extra hazard, in that they form the basis of point obstruction to the bowel by adhesive bands, is obvious to all who have followed the course of these cases.

One does better to remove contaminated or irritating fluids, such as duodenal or gastric contents from acute perforation and bile, when such has escaped widely, by means of the suction tip. Closing the source of the leak is important if this has not already been spontaneously accomplished. In diffuse peritonitis of the inflammatory type seen in perforated appendicitis, one can seldom aid in the recovery by the establishment of drains to the gutters and the pelvis, as is so often practiced. Much can be accomplished by the drainage of a localized abscess or an area where leakage may take place. Care must be used to avoid contact with a suture line or it will leak in a disconcerting manner; also, material used for drainage must not come in contact with the small bowel.

Care should be used to place drains from the biliary system away from the main wound if possible. Needless wound infection, dehiscence and hernia in the scar can thus be avoided.[11] The suction method of Chaffin[12] has been used at the Massachusetts General Hospital to hasten the resolution of an abscess cavity. Our experience with this method in bile peritonitis has met with less success. It is, however, a logical method of carrying off the discharges of a fistulous tract and has much to commend it.

Chemotherapy

Chemotherapy is justifiably credited with improving the results in gastrointestinal surgery. Anglem and Clute[13] believe that it decreased the mortality rate in 75 consecutive cases of resections. They have reduced the amount of the drug used intraperitoneally from about 15 to about 5 gm. They dust the suture line with sulfanilamide powder and use some in the abdominal wall. The use of this method around the suture line has also been approved by Whipple.[14]

Loria[15] has compared the results in 100 consecutive cases of gunshot wound of the abdomen treated at the Charity Hospital in New Orleans. Forty-nine patients received chemotherapy, with a mortality rate of 18 per cent; 51 had no chemotherapy, and 51 per cent of them died.

All writers are in agreement that proper use of the sulfonamide drugs has been beneficial in dealing with surgical lesions prone to give rise to trouble from infection. The manner of use of these agents is changing as experience accumulates. In order to avoid some of the serious complications of the drug, it is well to weigh the evidence carefully. The relatively soluble sulfanilamide is absorbed from the peritoneal cavity with great rapidity. The transmission of large amounts of this drug through the portal system may account for the liver damage often noted. That many patients rapidly recover from jaundice that occurs is admitted, but if this concentration can be avoided it is obvious that the patient has less to combat in his fight for recovery. The less soluble drugs should probably not be used in the peritoneal cavity, since there must be some foreign-body reaction from them before absorption takes place.

The use of these chemical agents in abdominal wounds has met with less enthusiasm than formerly and probably will eventually be entirely abandoned. Although the bacteriostatic effect within the potentially contaminated wound may appear helpful in some cases, there has resulted delayed wound infection that is more troublesome than the earlier form noted before chemotherapy was known. It seems likely that delayed closure of the skin and fat layers, as emphasized by Coller and Valk,[16] is a better method of meeting the situation.

Since it is known that a high concentration can be quickly obtained by the intravenous use of sulfadiazine and that tissue fluids carry essentially the same concentration as that of the blood stream,[17] it seems likely that wide application of the principle is indicated. This method of chemotherapy in abdominal surgery, to the exclusion of all others, has been used at the Massachusetts General Hospital for over a year, and we are better satisfied with the results.

Femoral Hernia

Femoral hernia has been difficult to cure. The recurrence rate in most clinics is several times that for inguinal hernia. Moore[18] reports on the results from the New York Hospital and recommends a new approach. An incision is made over the lower third of the inguinal canal, and dissection is carried deep and to the inferior border of Poupart's ligament. In this manner, the lower borders of the inguinal ligament and Cowper's ligament are adequately exposed. These structures can be approximated with three mattress sutures of silk in such a manner as effectively to close the femoral opening. In 40 cases thus treated, there were no recurrences.

It is doubtful that the results by this method will prove to be any better than the commonly practiced procedure of closing the femoral opening by approximating the ligaments from the cephalward border of the inguinal ligament. That the new method requires less dissection is obvious, and it may be adopted to advantage by those who prefer to expose the femoral ring only from below.

Stomach

Gastric Ulcer

Gastric ulcer has been analyzed by Judd and Priestley[19] on the basis of treatment at the Mayo Clinic. They found that slightly less than half the patients treated medically had satisfactory results, whereas only 1 patient of 162 treated surgically was dissatisfied. None of the patients operated on developed anastomotic ulcer. The operative mortality was 2.5 per cent. Ten per cent of the cases diagnosed and treated as benign ulcer proved to be cancer.

This study is in accord with experience at the Massachusetts General Hospital.[20] We found our percentage of diagnostic errors to be 14 per cent. The mortality rate for gastrectomy for gastric ulcer is less than that for a similar procedure for duodenal ulcer because the duodenal stump creates no problem. We also found that cancer of the stomach, thought to be ulcer at the time of operation, gave a 40-per-cent chance of a five-year cure, as compared with a 21-per-cent chance in clinical cancer. It is our belief that gastric ulcer must be considered on a different basis than duodenal ulcer, and that the management of the two lesions is quite opposed. Duodenal ulcer is primarily a medical problem, whereas gastric ulcer is primarily a surgical one. If the term "peptic ulcer" could be abandoned, there would be less confusion. Too many cases of early cancer of the stomach are being treated as peptic ulcer, the true nature of the lesion being manifested only when cure is impossible.

Cancer

Cancer of the stomach continues to lead the list for deaths from cancer in this country. Greater attention must be given to the education of the public and of physicians concerning the early symptoms of this disease. So far, surgery offers the only method of cure. In spite of the increased scope of surgery, there still remain a large majority of these victims appearing too late for help.

De Amesti,[21] of Santiago, analyzed 107 consecutive cases of cancer of the stomach personally treated. He was able to accomplish partial gastrectomy in 43 and total gastrectomy in 9. This is a higher resectability rate than can usually be carried out in such patients seen in the United States.

Pack and McNeer[22] have collected 303 cases of total gastrectomy for cancer. The technic is now

well established, and there are undoubtedly hundreds of unreported cases. Members of the staff of the Massachusetts General Hospital alone have done more than 100 total gastrectomies. Eleven of these were high lesions involving the cardia and lower esophagus and were accomplished transthoracically. Many of these appeared unfavorable from the standpoint of nodal involvement and extension of the disease to neighboring structures. The mortality rate is lower than formerly, the extent of the procedure has increased, and the respites have well justified the effort.

Farris, Ransom and Coller[25] followed their patients surviving total gastrectomy from the standpoint of nutrition and hematopoiesis. Five of the 29 patients operated on since 1937 failed to survive the procedure, with only 2 deaths in the last 19. These writers state that there is no experimental evidence to support the clinical impression that pernicious anemia may follow total gastrectomy. They carefully checked the digestion in a woman of forty living for over four years after total gastrectomy. She did have a tendency to develop hypochromic microcytic anemia. The loss of the stomach, it is stated, interferes with the metabolism of iron, and anemia is easily controlled by the periodic administration of ferrous sulfate. The stomach does not play an essential role in the digestion of fat and protein. Glucose is absorbed more rapidly than normal in these patients. The mobility of the intestinal tract is finally decreased in spite of the fact that some of the patients have diarrhea immediately after operation. This is doubtless due to the tendency to feed carbohydrates in the early days. A high-protein and low-carbohydrate diet is recommended.

Balfour[24] found that gastrectomized rats did not gain weight on their usual diet. If, however, he fed them rat stomachs, their weight increased and their anemia improved.

Polypoid Lesions

Polypoid lesions of the stomach have been well analyzed by Spriggs and Marxer[26] in a complete issue of the British *Quarterly Journal of Medicine*. The differential diagnosis of true adenomatous polyps and polypoid gastritis is illustrated by case reports, drawings and roentgenograms. They include leiomyomatous lesions in their study. Attention is called to the neoplastic nature of true polypoid tumors as compared with the inflammatory origin of polyps found in gastritis. The ratio of malignant degeneration was lower than that found at the Massachusetts General Hospital[36] and by Pearl and Brunn.[37] The latter investigators, in a second analysis of the subject, have collected 84 cases of multiple gastric polyposis and added 3 cases of their own. In their group, as in ours, bleeding was the rule and achlorhydria was present in almost every case. In 19 of 37 cases with sufficient data, malignant degeneration had occurred. This is higher than the 41 per cent of malignant degenerations found in our series. Although some of these cases, as well as those reported by Spriggs and Marxer, were followed for many years without evidence of cancer, it is agreed by all that resection of the involved segment is the rational treatment.

Duodenum

Heuer and Holman[28] have challenged the usually accepted theory that the postoperative acid level in the stomach contents influences the result in patients subjected to surgery for duodenal ulcer. They have carefully followed a group of patients treated by gastroenterostomy and minimal, moderate and extensive resection. Many of the cases with a satisfactory result still had an acid level higher than normal. A greater proportion of satisfactory results were obtained by radical subtotal gastrectomy, but the series was small. Patients with anacidity or low acidity postoperatively had a 10 per cent greater chance of a satisfactory result than did those who continued to have a normal or higher than normal level. These writers justifiably question the rationale of the more radical procedures, and believe that there are other factors than the acid level that are responsible for the results.

Friedall, Shaar and Walters[29] found that 75 per cent of their patients subjected to partial gastrectomy for duodenal ulcer had a reduction in gastric acidity. Patients who had had previous perforation or had developed anastomotic ulcer following gastroenterostomy needed a more radical resection than did those without complications.

Church and Hinton[30] report the follow-up results on 104 cases of gastric resection for ulcer. The majority of these were for duodenal ulcer, although, unfortunately, some were for gastric and marginal ulcer, making deductions difficult. The cases were followed for an average of 2.9 years. The sex ratio was 9 males to 1 female. The ages varied from sixteen to sixty-nine. The average duration of preoperative symptoms was eight years. Sixty-five per cent of the stomach was removed, including the duodenal ulcer. Sixty-six per cent of the patients were cured, 25 per cent were benefited, and 9 per cent were not relieved. Forty-six per cent had no free hydrochloric acid after operation, and some of these were in the unbenefited group.

Hinton[31] believes that pain persisting in spite of adequate treatment and massive hemorrhage are the chief indications for surgery in duodenal ulcer. Intractability is, in fact, synonymous with unrelievable and persistent pain. He also believes that surgery is indicated in massive hemorrhage, regardless of the age of the patient, if continuous transfusion fails to improve the situation. He thinks that it is important to remove the segment of duodenum containing the ulcer, and has been able invariably

to include the ulcer site in the resection. This experience differs somewhat from that of others.

Lahey and Marshall[32] have published an excellent article on the surgical management of duodenal ulcer. Their experience with ulcers in the second and third portions of the duodenum, as well as those with extensive inflammatory involvement, is in accord with that of most surgeons dealing with these lesions. One must be prepared to meet ulcerations of the duodenum that are not safely resectable.

Wangensteen[33] has used the idea proposed by Scrimger[34] and Estes[35] in closing the denuded antral segment. In 15 cases when he found the involved duodenum unresectable, he used the approved modification of the Finsterer exclusion procedure. After removing the mucosa from the antral segment, he approximated the remaining tissues face to face close to the pylorus by mattress sutures, instead of inverting them in the usual manner. This allowed him to trim away excess of the segment and to make a satisfactory leak-proof closure. He left room for an additional row of sutures along the cut edge, with no attempt at inversion. There were no complications in this series.

Andrus, Lord and Stefko[36] have reported their experimental and clinical experience with jejunal transplants to the stomach for the reduction of the hydrochloric acid level. In animals, this procedure was effective in every case. Five patients with duodenal ulcer were recently subjected to this operation, and the immediate results were satisfactory.

Colp and Druckerman[37] have used jejunostomy for feeding in 51 patients. These were preliminary in 6 cases and complementary in 38. There were no deaths from the jejunostomy, and these writers are enthusiastic over the benefits derived from it. They state that for this purpose, the pursestring type of jejunostomy is preferable to the Witzel type, which corroborates the opinion held at the Massachusetts General Hospital.

Lynn, Hay and Wangensteen[38] have had an unusually high percentage of difficulty from stasis in the duodenal loop following gastrectomy. One patient developed gangrene of the duodenum after resection of the stomach for carcinoma; 3 additional patients succumbed to the toxic effects of this loop, which failed to drain into the jejunum or remnant of the stomach. They devised a two-pronged nasal tube that was introduced into the stomach preoperatively. After the anastomosis is partially done, one prong of the tube is placed in the duodenal and the other in the distal jejunal segment.

Proximal jejunostomy for drainage of the stomach segment has been used at the Massachusetts General Hospital during the past year.[39] In 63 cases, this method obviated the need of the Levine tube in all but 3. In these failures, we are sure that the catheter left the stomach segment through the anastomosis and therefore failed to drain anything but duodenal contents. The patients like the method, and no complications have arisen from its use. A No. 16 French double-eyed catheter is introduced through a pursestring opening in the distal jejunum approximately 15 cm. from the anastomosis. A lubricated stylet aids in its introduction 7 to 10 cm. within the stomach segment. The catheter is brought out through a tiny stab wound in the left side of the abdomen.

Small Intestine

Hinchey[40] reports 13 cases of gallstone ileus from the Salem Hospital. A seventy-nine-year-old woman survived two operations at intervals for this type of obstruction.

Wangensteen[41] advises aseptic suction decompression enterostomy at the time of operation for gallstone ileus, and has applied this technic to emptying the small bowel in obstruction from other causes. The revival of the Monks's[42] method was brought out by Cheever[43] several years ago. When the Miller-Abbott tube fails, the technic of Wangensteen has much to commend it. Many patients have been known to succumb to the toxins absorbed from unemptied, obstructed loops of small bowel after release of the obstructing focus.

A further report from the University of Minnesota Hospitals[44] on small-bowel obstruction emphasizes the importance of having this group of patients treated by special assignment. Their mortality rate has been reduced from nearly 20 to 7.4 per cent in the past year.

Smith and Van Beuren[45] report the results of treatment in 130 cases of acute ileus treated at the Presbyterian Hospital, New York City, from 1936 to 1939. This makes a consecutive report covering twenty-four years' experience in that clinic by the same authors. The mortality has decreased from 66.6 per cent in 1916-1919 to 23.8 per cent in the last series. Since the Miller-Abbott tube has been available, the mortality in 36 cases was 19 per cent; eliminating 4 deaths from paralytic ileus, there remained a 10 per cent mortality from mechanical obstruction.

Schottenfeld[46] has collected 275 cases of lipoma of the gastrointestinal tract, including 6 of his own; 56 per cent were in the small intestine, and 30 per cent in the ileum. Intussusception occurred in a large percentage of these. The mortality with intussusception from lipoma was 25 to 30 per cent. Three of his cases were found incidentally at autopsy, and 3 were operated on with recovery.

Gerwig and Stone[47] report a case of intussusception from a jejunal polyp and call attention to the rareness of polyps of the small bowel in comparison with those of the colon. They quote Lawrence,[48] who found 4 cases of polyp in both the small and large bowel in 232 cases of gastrointestinal polyposis that came to autopsy.

Keyes[49] again calls attention to the proper approach to fistulas of the small bowel. The operation

is done through a clean field, leaving a small segment of bowel containing the fistula to be removed later or left alone. This attack has much to commend it and can be made easier if a Miller–Abbott tube can be introduced to the point of the fistula. A second tube inserted in the distal limb is valuable if this can be done, since it makes the identification of the fistulous loop a simple matter.

Ginzburg and Garlock[50] review 77 cases of regional ileitis treated in their clinic. In 23 cases of ileocolic resection, there were 4 deaths. In 54 patients treated by ileocolostomy for exclusion of the diseased process, there were no postoperative deaths. Two patients in this group finally succumbed to sepsis; and 3 were subjected to late secondary resection of the diseased segment because of continued symptoms. In those having primary resection, 3 developed proximal involvement, whereas in the larger group only 2 acquired new areas of the disease. These writers conclude that exclusion by ileocolostomy is the procedure of choice and that the disease segment may be left alone unless it is a factor in continued disability.

Whipple[51] reports 1 death in 23 ileocolic resections for regional ileitis with the preoperative and postoperative use of the Miller–Abbott tube.

Lahey and Sanderson[51] in their recent article on right colectomy by the modified Mikulicz procedure report 1 fatality in 53 cases of regional ileitis treated by this method.

Colon

Singleton[52] has written an illuminating article on the blood and lymphatic supply of the large bowel. The high incidence of abnormal blood supply, especially to the distal transverse and splenic colon, is of the utmost importance, particularly since the transverse colon beyond the midline may be devoid of anastomotic vessels from the left colic artery. Resection of this segment is likelier to result in gangrene of the remaining portion of bowel than is that of any other by the usual procedures. For this reason, one cannot depend on the types of operation that either fail to visualize the blood supply or limit the resection to the distal transverse segment.

Whipple[51] believes that the preoperative and postoperative use of the Miller–Abbott tube has materially reduced his mortality in resections of the large bowel. Resections of the right colon for cancer in 16 cases in his clinic, without the aid of intubation, resulted in 3 fatalities, whereas in 41 cases in which the Miller–Abbott tube was used, there were only 4 deaths. From 1933 to 1937, resections in 38 cases resulted in 8 deaths, whereas from 1938 to 1942 there were only 7 deaths in 57 cases of resection. Experience and chemotherapy may have played some role, although most of the credit is given to decompression of the bowel by intubation.

Babcock[53] has devised new clamps for aseptic anastomosis in gastrointestinal surgery. This is the so-called "one clamp" method and the instruments are a modification of the Rankin, Stone and Wangensteen varieties used for this purpose. Babcock reports resections in 65 serious and complicated cases — 35 of the stomach, with 4 deaths, and 30 of the intestine, with 4 deaths.

Fallis[54] reports the results in 31 cases of lesions in the lower sigmoid and upper rectum treated by anastomosis after the method described by Dixon.[55] The operation resulted in 2 deaths, and the complications were not extreme. Preliminary transverse colostomy is recommended. Stricture at the suture line was troublesome in some cases. Dilatation of the stricture was satisfactory in some, but permanent colostomy was finally resorted to in others. Drainage of the area is necessary because the suture line is below the peritoneal floor. Healing in this area is slower than it is in cases of peritonealized bowel.

Smithwick[56] states that 5 per cent of all people over forty years of age have diverticulosis of the colon. Of 333 patients hospitalized for diverticulitis, 64, or 19 per cent, were treated surgically. The best results were obtained by preliminary transverse colostomy. Resection and anastomosis of the diseased segment was best carried out from three to six months after the defunctioning colostomy.

Schnug[57] reports 6 cases of acute diverticulitis of the cecum, and collected 32 cases reported in the literature. All were diagnosed preoperatively as acute appendicitis, but in 1 resection was performed on the operator's diagnosis of cancer. Three lesions were removed locally, one was left alone, and one abscess was drained. Schnug believes that these lesions are best treated without surgical drainage or resection. The majority of the patients were under forty years of age. One third of them had had previous attacks. The lesions are usually solitary, and the mouth of the diverticulum can often be palpated through the cecal wall.

Biliary System

Gordon-Taylor[58] reports experimental data to refute the theory of the sphincter mechanism of the lower end of the bile duct. No circular muscular fibers can be found in this region. Only longitudinal and oblique fibers exist, and these are in the distal portion of the papilla of Vater. The action of these fibers, Gordon-Taylor believes, is partly to retract the papilla and partly to erect or aggregate the villous processes centripetally. By this action, duodenal reflux is prevented and the bile flow controlled. It is well to mention the value of the oblique direction of the duct through the duodenal wall, with overhang of mucosa often, if not always, present.

Gray and Sharpe[59] call attention to the probability that biliary dyskinesia is caused by remnants of the lower end of the gall bladder or cystic duct that are left during cholecystectomy. Of 44 cases studied, 26 had no residual stones; 7 of these were unrelieved

after a second operation, and the authors question the original diagnosis of cholecystic disease. Complete relief was obtained in 11 of the 24 cases without stones that were followed. In 18 cases of residual stones, the stones were in the common duct in 11 cases, with complete relief in 6 and no relief in 4 of the 10 cases followed. In 7 cases with residual stone in the cystic duct, 6 were followed; 5 patients had complete relief, whereas 1 had none. The common duct was normally dilated in all cases with stones. Duodenal adhesions were frequent. Some patients had a degree of hepatitis and some had pancreatitis. Thirty-five patients had definite inflammation of the remnant of the cystic duct. No mention is made of instrumentation of the papilla of Vater in these cases. Two cases of residual stone in an inflamed cystic duct producing marked symptoms of biliary dyskinesia, which came on years after cholecystectomy, were recently seen at the Massachusetts General Hospital. In both cases, the common bile duct had not dilated normally, as it usually does after cholecystectomy. Both were relieved by the removal of the remnant of the cystic duct and a dilatation of the papilla to 6 mm. In both cases, the papilla was abnormally tight.

Dragstedt et al.[60] report a new technic for re-establishing continuity between the bile duct and the duodenum. A No. 18 French catheter is inserted in the hepatic duct a distance of 5 cm. This is implanted in the wall of the duodenum, after the method of Witzel, with silk technic. The catheter is then brought through the duodenal wall and led through its lumen and out again at some distance. In this manner, the bile is drained to the outside for ten days and the catheter is then removed. This resulted in a two-year cure in a thirty-five-year-old woman. These writers suggest that a similar procedure can be used in the pancreatic duct following resection of that region for carcinoma.

Pancreas

The variability in behavior of the pancreatic remnant after experimental ligation of the duct is discussed by Dragstedt.[61] In some animals the pancreas atrophied completely, whereas in others the structure was maintained. In those developing a complete fibrosis, the absence of lipocaic action on digestion was evidenced. Dragstedt proposed and carried out intubation of the duct with a ureteral catheter, which was led through the duodenal wall and out again, draining the pancreatic juice to the outside for a period of time. This he believes might improve the results in partial pancreatectomy for carcinoma.

Whipple[62] discusses the subject and illustrates his present one-stage procedure for resection of the duodenum and pancreatic head for cancer. The end of the jejunum is anastomosed to the cut end of the bile duct. The cut end of the pancreas is implanted in the side of the jejunum, and the cut end of the stomach is then anastomosed to the jejunum, end to side.

Phillips[63] reports a failure due to difficulty with the end of the pancreas and proposes a method similar to that suggested by Dragstedt and Whipple.

Rockey[64] cites a case of total pancreatectomy with death fifteen days later from bile peritonitis, owing to a leak from the cut end of the common bile duct. He believes that a patient may get on satisfactorily without any remaining pancreatic tissue, since the insulin needs are easily controlled. Lipocaic can be added to the diet.

Spleen

Sweet[65] adds 3 cases of true simple cyst of the spleen. He quotes Fowler,[66] who states that 21 per cent of 137 collected cases are of this variety. The differential diagnosis is discussed. All the patients are young and are conscious of a huge abdominal mass. The tumor feels cystic and is nontender. The roentgenograms give a characteristic picture.

Zabinski and Harkins[67] have collected 177 cases of delayed splenic rupture, including 4 cases of their own. This clinical syndrome, following trauma, is one that should always be considered in the differential diagnosis of the acute abdomen.

McLaughlin[68] encountered 30 cases of familial hemolytic jaundice during the last five years, and advised splenectomy in 16 because of clinical and laboratory evidence that the disease process was not latent. Thirteen patients who accepted this advice successfully underwent splenectomy. During operation and in the hour following there was a uniform rise in hemoglobin, which averaged 23 per cent. The red-cell counts correspondingly rose during this same period, with an average increase of 1,100,000 cells. Both the hemoglobin and cell readings fell gradually during the next two days and gradually increased to normal by the end of the first postoperative month. The leukocyte count also rose temporarily during splenectomy. There was no recurrence of the hemolytic factor in any of the 13 patients operated on. If hemolytic factors return after splenectomy, McLaughlin deducts that the original diagnosis was incorrect, that overlooked splenic tissue has become active or that hemolymph nodes have hypertrophied and have assumed a hemolytic character.

Eliason and Stevens[69] review the literature of the last ten years and give a statistical report showing the mortality and life expectancy following splenectomy in splenic anemia, thrombocytopenic purpura and icteroanemia. To this they add a report of 63 personal cases. Splenectomy gives the patient with splenic anemia the best chance for recovery, and the earlier in the disease it is performed, the lower is the surgical mortality and the greater the life expectancy. Eliason believes that splenectomy should be done even in the presence of cirrhosis. The operative mortality is approximately 10 per cent. Some

of these patients have lived for twenty years postoperatively. Patients with chronic hemorrhagic purpura who do not respond to conservative therapy should be given the benefit of splenectomy. Also, in acute or fulminating hemorrhagic purpura that does not respond promptly to therapy, splenectomy should be performed before the patient's condition becomes critical. It is important to eliminate infection in the prevention of recurrent purpura. Splenectomy is the treatment of choice in hemolytic jaundice, particularly in children. It is preferable to perform the operation during a remission. In adults, splenectomy is not always necessary.

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CASE RECORDS OF THE MASSACHUSETTS GENERAL HOSPITAL

Weekly Clinicopathological Exercises

FOUNDED BY RICHARD C. CABOT

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CASE 30031

PRESENTATION OF CASE

A twenty-one-year-old college student who was spending a week end at the beach in midsummer awoke at five o'clock one morning, eight days before admission to this hospital, with severe knife-like pain in the left chest. He rapidly became feverish and within a few hours began to cough up rusty sputum. He took a taxi to the college infirmary, where x-ray examinations showed opacity of the entire left lung field. The sputum typing showed a Type 18 pneumococcus. With the administration of sulfadiazine, the pain, fever and discomfort gradually subsided during a period of seven days and then suddenly became worse, when he was transferred to this hospital.

The patient was reported to have had pneumonia five times within the preceding ten months. It was further alleged that a different lobe had been involved on each occasion and that a different type of pneumococcus had likewise been recovered in each of the various episodes.

The past history recorded the onset of mild diarrhea at the age of one and a half years, which persisted essentially without remission until the age of eighteen, when dilute hydrochloric acid was prescribed with complete and permanent relief. At the age of four and a half an adenoidectomy was performed. Two days later he developed a severe attack of pneumonia, and from that time on suffered one or two attacks of pneumonia every year. These were diagnosed sometimes as lobar and sometimes as lobular in type. At thirteen he had an attack of pansinusitis, when the gastric hypochlorhydria was discovered. At nineteen he had an attack of mild prostatitis that was persistent and failed to respond to sulfanilamide and massage.

The family history revealed that one grandmother was asthmatic.

Physical examination on entry was sketchy because of the patient's condition. The facies appeared anxious and drawn. He was in obvious distress, with labored grunting respirations and complete splinting of the left side of the chest. There were patchy dullness and bronchial breathing in the upper portions of the left chest; over the area of the left lower lobe there were dullness and absent breath sounds. The heart was not enlarged, and there were no murmurs; the pulmonary second sound was greater than the aortic. The abdomen was flat and soft, and no masses or tenderness were made out. The mucous membranes and nailbeds did not appear cyanotic.

The rectal temperature was 103°F., the pulse 120, and the respirations 30.

An x-ray film of the chest taken with a portable machine the day after entry showed the following: "There is hazy density occupying the lower half of the left lung field. The left diaphragm is elevated, and the heart and mediastinum are not displaced. The right lung field is clear. Comparison with a film taken several days before at the college infirmary shows considerable clearing." The following day fluoroscopy showed a triangular area of density involving the midportion of the left lower lobe, which was interpreted as either atelectasis or fluid. Another film from the infirmary, taken four months before entry, after clinical recovery from his last attack of pneumonia, showed incomplete expansion of the left lower lobe.

Laboratory studies at the time of entry showed a hemoglobin of 13.0 gm. and a white-cell count of 14,800, with 75 per cent neutrophils. The urine had a specific gravity of 1.010 and contained no albumin or sugar; the sediment was free from red cells, crystals and casts. A blood Hinton test was negative. The blood sulfadiazine level was 3.5 mg. per 100 cc. Three sputum examinations showed alpha-hemolytic streptococci but no pneumococci. Two blood cultures were negative. The sulfadiazine dosage was increased to 6 gm. per day, and a blood level of 6.2 mg. per 100 cc. was obtained. On this regime the temperature fell to normal on the fourth day and, with one exception, remained normal for six days, the sulfadiazine having been stopped on the fourth day of normal temperature. Physical examination showed complete clearing of the upper lobe and improved aeration of the lower lobe.

On the eleventh hospital day the patient complained of sharp inspiratory pain over the anterior left rib margin and a sensation of chilliness. The temperature rose to 101°F, the pulse from 80 to 110, and the respirations from 20 to 30. There was no change in physical signs, however, and an x-ray film taken with a portable machine was interpreted as showing improvement since the last examination. A sputum examination showed mucopurulent material without blood staining, and from it a Type 18 pneumococcus was grown in pure culture. A few days later, however, a roentgenogram showed a marked change — the development of hazy density obscuring the entire left lung field. After a negative conjunctival serum test, the patient was given

*On leave of absence.

2 cc. of undiluted Type 18 rabbit serum, which was followed by a severe chill forty minutes later. Sulfadiazine was again administered. During the third week a loud harsh to-and-fro friction rub obliterating the normal heart sounds was heard in the third interspace just to the left of the sternum. The blood pressure was 90 systolic, 45 diastolic, and continued to be low, although the circulation in the extremities appeared to be satisfactory. He looked slightly cyanotic although he had not been given sulfadiazine for four days, during which period the temperature dropped to around 100°F. When the chemotherapy was resumed the temperature rose to 102°F. The pericardial friction rub cleared, although he continued to have chest signs suggestive of consolidation and pleural fluid. Three chest taps, however, were "dry."

During the fourth week, bronchoscopy revealed large amounts of thick sticky greenish-yellow secretion in the left bronchial tree. This was aspirated, leaving a slightly reddened but otherwise normal mucosa. The orifice of the left lower lobe appeared normal. The aeration of this lobe was much improved after aspiration, and it was planned to continue this procedure by means of an inlying rubber catheter in the left main bronchus, which, however, the patient coughed up after fifteen minutes. His condition continued to be poor, and he raised large amounts of thick greenish-yellow material. A chest tap at the third interspace in the left midclavicular line yielded 100 cc. of sticky serosanguineous fluid from which a Type 18 pneumococcus was cultured. On the twenty-sixth day the pulse was paradoxical, with a rate of 140. The apex impulse was diffuse and tic-tac. A diagnosis of pericarditis with effusion was made, and a tap was attempted. No fluid was obtained, and it was thought that the pericardium was thickened. Three days later a roentgenogram of the chest showed practically no air in the left lung field. The right border of the heart was displaced farther to the right, and there were no visible pulsations along the right border with the patient in the horizontal position. A pericardiotomy was performed, with drainage of about 10 cc. of purulent material, which also yielded a Type 18 pneumococcus on culture. A biopsy of the pericardium showed acute and chronic inflammation.

The pericardial drainage continued to be copious, and it was believed that a large amount of chloride was being lost, the blood serum chloride being 86.8 milliequiv. per liter. The serum protein was 3.8 gm. per 100 cc. The patient was given a transfusion of 500 cc. of blood and 2 liters of saline, followed the next day by 500 cc. of plasma. Because of persistent fever, tachycardia and continued purulent pericardial drainage, the sulfadiazine was stopped and 15 cc. of penicillin (7500 units) was placed in the pericardial cavity.

On the thirty-seventh day a rib resection was performed, with drainage of 10 cc. of pus from an empyema over the apex of the left lung. Because of the difficulty in maintaining adequate electrolyte balance, — the nonprotein nitrogen was 12 mg. per 100 cc., the chloride 98.2 milliequiv. per liter, and the protein 4.9 gm. per 100 cc., — he was given 10 cc. of adrenocortical substance. He was also given a total of 100,000 units of Type 18 antipneumococcus rabbit serum without any reaction. The next day he began to fail rapidly; in spite of being kept in an oxygen tent, he remained cyanotic and died the following day, forty days after admission.

Differential Diagnosis

Dr. Charles A. Janeway:* This case represents an unsolved bacteriologic problem. Here we have a man who from early life was unable to cope with infections that the majority of us could handle fairly readily.

An interesting point is that the patient went to an infirmary within a few hours after an attack of pneumonia began. He had density involving the whole left chest, and that is unusual for ordinary pneumonia in the first day. At such a time one may even have difficulty by x-ray in making out more than a small patch poking out from behind the heart. That to me is the first indication that something was wrong with this boy's lung other than what he came down with at the specific time.

He was treated with sulfadiazine. He apparently had a Type 18 pneumococcus pneumonia, although that is one of the higher types and not necessarily pathogenic. When Type 18 is found on direct typing, however, lobar pneumonia must be identified with this organism unless one can prove something else. He responded to sulfadiazine for seven days and then became worse. It is not a usual situation for someone with lobar pneumonia to be treated for seven days and develop an apparent relapse. This boy's treatment was adequate, so apparently there was something peculiar about the boy. When he was admitted he had a blood diazine level of 3.5 mg. per 100 cc., which is grossly inadequate if that is all he had throughout the course of the pneumonia. One would feel that he had a relapse because of insufficient chemotherapy. There is no question, I believe, that organisms do tend to develop a certain amount of resistance to the sulfonamide drugs. It is important in treating patients with acute infections, once one makes the decision to use chemotherapy, to treat immediately and intensively.

The past history is exceedingly interesting. He had had pneumonia five times within the preceding ten months, which is a most unusual story. I remember one patient, a boy with a nephrotic type of hemorrhagic nephritis, who in the course of two years had eight pneumococcal infections and four of these were due to Type 8. In the present case, the patient had a different lobe involved each time,

*Assistant professor of pediatrics, Harvard Medical School.

and with a different type of pneumococcus. One must assume that there was something obviously wrong in that he was unable to resist infection with the pneumococcus. That is an unexplainable situation, so far as I know, in terms of present bacteriologic knowledge, but it is not too uncommon a story. Some persons have furuncles and develop a generalized staphylococcal infection with osteomyelitis. Others are prone to repeated occurrences of lobar pneumonia, and then there is the group best exemplified by children with rheumatic infection, who are constitutionally unable to handle infection with the hemolytic streptococcus. When we go into the past history of this boy we know that he had an attack of mild diarrhea at one and a half years and that this continued until the age of eighteen, when he was given hydrochloric acid. That again suggests some sort of constitutional defect, because hypochlorhydria or achlorhydria is not common at that time of life and perhaps represents a true functional deficiency of the stomach.

This patient's troubles began at four and a half years, when his adenoids were removed. Two days later he developed pneumonia, and from then on had one or two attacks a year. These were diagnosed sometimes as lobar and sometimes as lobular in type, which does not matter; presumably they were pneumococcal infections, although we do not know. At thirteen he had an attack of pansinusitis, another common form of pneumococcal infection, although it might have been streptococcal. At nineteen he had prostatitis, which was persistent and failed to respond to sulfonamides and massage. This is not at all unusual in patients prone to repeated attacks of upper respiratory infection, and no one can say to what it is due. But all these things point to a person who has a low resistance to infection in general, and particularly to infection in the respiratory tract caused by the pneumococcus.

On entry there were dullness and absent breath sounds in the left lower lobe, and x-ray examination showed hazy density of the lower half of the left lung field, with elevation of the diaphragm on the left. This is in contrast to the picture taken on entry to the infirmary, when he had density involving the whole chest. One is forced to the conclusion that something was wrong with the left lower lobe. Perhaps the process in the upper part of the chest had cleared on sulfadiazine therapy.

May we see the x-ray films?

Dr. George W. Holmes: To discuss these films completely would take the whole hour. The patient had repeated attacks of pneumonia, and one wonders whether or not there was some trouble in one of the bronchi. Apparently someone else thought of that, since lipiodol was injected into the bronchi. From this film I cannot say definitely that he had or had not any trouble with the bronchi. It is not the usual picture of bronchiectasis; yet it is not quite normal.

Another thing that is fairly striking about the case is that the heart shadow became progressively larger. Whether he developed fluid in the pericardium or whether the change was due to long-standing intrapulmonary pressure, I cannot tell. Another unusual thing is the development of this density, which includes the entire lung. There is no evidence that the mediastinum was displaced or that the heart was pushed to the right.

Dr. Janeway: Do you not believe that the heart was being pushed to the left?

Dr. Holmes: I cannot answer that definitely, but my feeling is that there was no change in the position of the heart and mediastinum.

Another point is that the process extends to the extreme apex, which is unusual in the presence of fluid. It is seen, however, with complete consolidation of the lung or with tumor. This process comes and goes, and that is hard to explain. Fluid to that extent should displace the heart in the opposite direction. I should think that this was consolidation.

Dr. Janeway: I think that one can skip through the remainder of this patient's course fairly rapidly. He entered the hospital, as I have said, apparently with considerable change from the first film to the second. Probably the most satisfactory explanation is that he had pneumonia involving the upper portion of the lung. He was treated with sulfadiazine, and most of the process cleared; but a residual was present in the lower lobe, where there were dullness and diminution of the breath sounds. Another thing that strikes me on looking at these films is the contrast between the rib shadows on the two sides; they are drawn closer together on the left than they are on the right. One does not see that in this film, which suggests that later on there was some collapse of the left lower lobe. By increasing the dose of sulfadiazine in a fairly short time the temperature was again brought down and there was clearing of the picture. Therefore, one must assume that because of insufficient therapy he had a relapse of pneumonia, which brought him to the hospital. Although more intensive chemotherapy aborted the infection, it obviously did not cure the patient.

From then on the story is that of someone with complications of pneumococcal pneumonia. After several days of normal temperature he had a second return of symptoms. There were inspiratory pain, pleural pain over the left rib, chills and a rise in temperature, with no change in physical signs. As one watches the course, it seems likely that this was a different sort of relapse from the first one, which was perfectly compatible with a relapse of the pneumonia. This time, I believe, purulent complications were beginning to develop in the left chest, because, from then on, sulfadiazine therapy was relatively ineffectual.

During the third week the patient had a to-and-fro friction rub, with a fall in blood pressure and slight cyanosis. This was accompanied by en-

largement of the heart, as Dr. Holmes has pointed out. There was not the slightest doubt that this boy had pericarditis, which, as you all know, is one of the most serious complications of lobar pneumonia, and formerly occurred in a fair percentage of cases. Here is a boy with almost no resistance to organisms who, in the presence of not too effective chemotherapy, went on to develop some type of purulent complication. An attempt was made to give serum therapy; possibly that should have been done earlier because obviously the boy did not handle pneumococcal infection too well. We do not know whether he had antibodies at the time the serum was given. Presumably he did or he would not have shown much in the way of focal complications. Another factor is that at that time the temperature went up when he was given sulfadiazine and stayed up when it was taken away. As a result of chemotherapy this boy had become sensitive to sulfadiazine, which further complicates the picture.

Another complication was present; this patient eventually had a rib resection because of an empyema, which was evidenced by the aspiration of a sticky purulent secretion, containing a Type 18 pneumococcus, from the region of the left lower lobe.

Perhaps the only intelligent way to put this all together is to say that there was some abnormality that rendered the left lower lobe peculiarly vulnerable, but this vulnerability to pneumococcal infection was probably on the basis of something constitutional, because the patient had had infections everywhere. Another point is that for some reason, possibly because of the development of a small abscess or because he developed a real bronchial occlusion as suggested by the pulling together of the ribs on the left side, chemotherapy, when given to him the first time, perhaps inadequately, failed to cure the infection. There is little question that there was some occlusion on the left because the bronchus contained sticky secretion, and because the infection in the left lower lobe never cleared up. Whether he had bronchiectasis, abscess or an unresolved pneumonia that flared up when the sulfadiazine level fell, I cannot tell.

I should say that at autopsy they found not only empyema and pericarditis but also pneumococcal infection in the left lower lobe, probably some bronchial constriction and therefore abscesses or some fibrosis and collapse. Why the boy died when he did I do not know, but I suspect that it was due either to the pericarditis or to the empyema, which did not respond to drainage. Possibly the infection broke into the peritoneum and produced peritonitis, but I doubt that.

Dr. John Cass: I attended this boy during the week before he came in here and there was no doubt in my mind that he was having another one of his series of acute pulmonary infections, with an underlying disease of a chronic nature. He did quite well for a few days, and then his lungs filled up again and he was admitted to this hospital. The day before he had had a blood sulfadiazine level of 8 mg. per 100 cc. The next morning the level was 3.6 mg., and we pushed the dose up until it reached a peak of 13 mg. He had an essentially normal temperature for three days except for one time when the sulfadiazine was stopped. At a level of 5 or 6 mg., he flared up again, and we immediately gave more sulfadiazine and kept him at a level of around 8 mg. for the next week. Then, the chest signs changed definitely overnight, an area of complete consolidation appearing. This same thing had happened in one of his previous attacks, when he had flared up overnight with consolidation of the left upper lobe.

The important thing was to get this boy over the acute disease. We all recognized that he had underlying chronic pulmonary disease, presumably bronchiectasis. We did everything that we could. We gave serum when he flared up again under sulfadiazine. He had a severe chill and was pulseless for a few minutes. With the first chill the temperature went up to 106°F., but the next day it fell down and stayed down for two days; then it started to go up again. Dr. Maxwell Finland saw him, and the question was raised whether to give serum again and stop the sulfadiazine. He had seen the boy several times during the previous year. He was not impressed with the Type 18 pneumococcus as the etiologic agent. We again tried sulfadiazine, bringing up the level as high as before, over 10 mg., without any effect. We pushed the sulfadiazine level higher by giving the drug intravenously, gave more serum and drained the empyema and the pericarditis. The chest signs did not change materially, and we believed that one lung was free of infection.

The patient died in a state of anoxemia. He was blue and that was the thing that made us realize that we were not dealing with a unilateral disease. He was cyanotic at all times except for three or four hours after the bronchoscopy, when air got into the lower left lobe for a few hours. We did not have the courage to subject him to bronchoscopy again. He was given oxygen and a mixture of helium and oxygen both by mask and by tent. Our diagnoses were the same as those of Dr. Janeway; we believed that the boy died of lobar pneumonia, with empyema, pericarditis and an underlying chronic diffuse pulmonary disease, probably bronchiectasis.

Dr. Janeway: Did he have a reaction the second time serum was used?

Dr. Cass: No.

Clinical Diagnoses

Lobar pneumonia (Type 18 pneumococcus).
Pericarditis.
Empyema, left.
Bronchiectasis: left lower lobe?

Dr. Janeway's Diagnoses

Lobar pneumonia (Type 18 pneumococcus): left upper lobe.
Pericarditis (Type 18 pneumococcus).
Empyema, left (Type 18 pneumococcus).
Bronchial constriction and atelectasis, with infection (Type 18 pneumococcus): left lower lobe.

Anatomical Diagnoses

Bronchiolitis fibrosa obliterans.
Bronchopneumonia.
Bronchiectasis, left lower lobe.
Pericarditis, acute, fibrinopurulent.
Empyema, left.

Pathological Discussion

Dr. Benjamin Castleman: At autopsy this man still had 10 to 15 cc. of pus in the pericardial cavity and some empyema. At the base of the drainage tube, over the visceral pleura, was a huge pocket of pus. The left lung was encased in a fibrous pleural capsule 1 to 2 mm. in thickness, and the whole lung itself was shrunken to about two thirds its normal size. On sectioning the lung there were numerous grayish granular foci 1 to 2 mm. in diameter that looked like miliary tuberculosis, and at the time of autopsy the diagnosis lay between tuberculosis and lobar pneumonia with small abscesses. In the left lower lobe the larger bronchi were filled with thick, tenacious material so that it would have been quite impossible for air to get through. The smaller bronchioles were also filled with this material and were distended to perhaps 0.5 cm. in circumference, so that there was definite bronchiectasis in the left lower lobe. The right lung, although not collapsed, was also encased in a thick fibrous pleura and on section showed a similar sprinkling of tubercle-like lesions throughout all lobes.

On microscopical examination of the left lung we found that the bronchioles were filled with exudate and that the walls were destroyed in places. There was also a great deal of organization of the exudate within the bronchi and bronchioles, especially in the smaller air sacs or alveolar ducts (Fig. 1). Immediately surrounding the bronchi there was evidence of recent infection. This reminded us of a condition called "bronchiolitis fibrosa obliterans," which was described by Lange[1] in 1901 and again fifteen years ago here in Boston by Blumgart and MacMahon.[2] The latter described 5 cases which simulated miliary tuberculosis but in which, of course, there was no evidence of tuberculosis. We were able to find similar bronchiolitis with fibrous-tissue plugs in the right lung, with a more acute pneumonic process around the bronchi. The disease on the right seemed to be definitely more recent than that on the left, but the fundamental chronic process was the same.

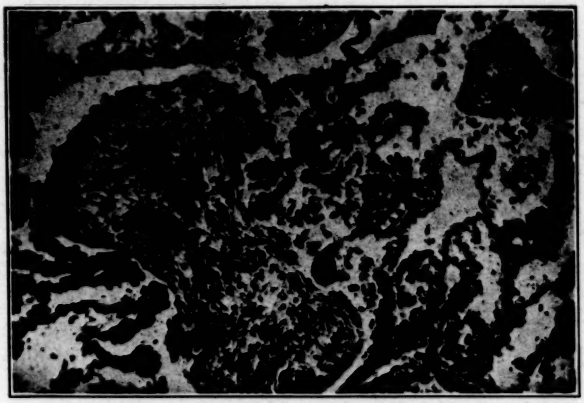

Figure 1. *Photomicrograph Showing Bronchiolitis Fibrosa Obliterans of an Alveolar Duct.*

The question arises whether this was the result of an organizing pneumonia and something that he had had for a long time or whether it was the disease entity that had precipitated the attacks of pneumonia. We have seen the same condition a number of times. This morning I looked through our files and found that we have made the diagnosis of bronchiolitis fibrosa obliterans seventeen times. It is interesting that in 5 of the 17 cases the patients had heart disease. Two of these were rheumatic in

origin, which is interesting in view of the fact that an organizing bronchiolitis has been described as a form of rheumatic pneumonia by Masson et al.[3] The other 12 cases were associated with pneumonia, organizing pleuritis, empyema or pericarditis, 2 of them occurring in patients with nephritis. Perhaps this is not a disease entity in itself but a nonspecific finding that develops with a diffuse organizing pulmonary infection caused by a variety of etiologic agents. For example, the pulmonary complications of the victims of the Cocoanut Grove fire who died after admission into the hospital showed an acute necrotizing bronchiolitis.[4] Those who had severe pulmonary damage and survived may well have developed varying degrees of bronchiolitis fibrosa and perhaps will be relatively nonresistant to future pulmonary infections.

In the later stages of the disease, failure of the right side of the heart may occur. This was true in the present case, the right ventricular wall being twice its normal size. There was no evidence of disease in any other organ.

DR. JANEWAY: If you assume this was a chronic process and not one that began with this particular infection, how can you reconcile that with so little change in the earlier x-ray films?

DR. HOLMES: I do not know exactly how much these cases of the type described show on x-ray, but I should certainly say that these films showed nothing abnormal except for the character of the lipiodol shadow in the left descending bronchus. That is abnormal, but it is not characteristic of bronchiectasis.

DR. CASTLEMAN: The right lung was encased in a thickened pleura that certainly antedated the recent disease.

DR. ALLAN BUTLER: If the patient had had bronchiolitis fibrosa obliterans previous to the last attack, then I should think that decreased aeration of the lung would have been noticed clinically and that he would have complained between times of dyspnea.

DR. CASS: He had not been well since he was four years old. The only exception to that was the three years spent in Arizona, and he was not active out there. He never completed a full year of school and really never did anything, just lived the life of an invalid. The first time I saw him he was cyanotic.

DR. JANEWAY: How about the kidneys?

DR. CASTLEMAN: They were normal.

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CASE 30032

PRESENTATION OF CASE

A fifty-four-year-old clerical worker entered the hospital because of "asthma" of three weeks' duration.

The patient was in good health until five months before admission, when she developed a severe steady pain in the lower sternum associated with and aggravated by an "awful" nonproductive cough. These continued for two to three weeks. About two months before admission she coughed up frothy white material flecked with blood for three days. She developed a "severe strain" between the scapulas. An x-ray film of the chest was said to have shown "adhesions between the lung and the diaphragm, clearing pneumonia and thickening of the pleura." She remained at home for six weeks without any relief. In the meantime her appetite declined and she developed abdominal and lower costal pain which she attributed to continuous coughing. Three weeks before entry she developed wheezing respirations and a filled-up feeling, in addition to the cough and pain. The cough was productive of a slightly odorous white froth with no thick exudate. The "asthma" improved slightly and the chest pain subsided. There was no fever, chills or night sweats, sinus pain, toothache, sore throat, hay fever or hives. She had had no upper respiratory operations, and there was no history of aspiration of a foreign body. The weight had remained constant until the three weeks before entry, when she had lost about 7 pounds. There was no history of a tuberculous contact.

Physical examination showed a well-developed, well-nourished, slightly dyspneic woman in no distress. There was no nasal obstruction. The "tonsillar nodes" were slightly enlarged and nontender. The diaphragm was in normal position and showed slight mobility. In the lungs there were scattered coarse, sticky rales, a few moist rales and rare sibilant rhonchi. The heart was normal. Examination was otherwise not remarkable.

The blood pressure was 120 systolic, 90 diastolic. The temperature was 98.6°F., the pulse 120, and the respirations 26.

Examination of the blood showed a red-cell count of 4,860,000. The white-cell count was 11,600, with 86 per cent neutrophils. The urine was negative. The blood sedimentation rate was 2 mm. in fifteen minutes and 22 mm. in sixty minutes. A blood Hinton test was negative.

X-ray examination of the chest showed a generalized increase in the lung markings, with diffuse haziness over the lower two thirds of the right chest and to a lesser degree of the left chest. A grid film revealed numerous small areas of diminished density having the appearance of bronchiectatic changes. The right diaphragm was adherent anteriorly. The

heart was not grossly enlarged. The aorta was tortuous and displayed calcification of the arch.

For the first few days she experienced considerable respiratory distress. She was orthopneic and wheezed heavily. There was no relief from adrenalin, but a certain amount of temporary relief from aminophyllin. She was given 1 gm. of sulfadiazine on the third day, followed by 2 gm. daily for the next six days. On the fifth day the blood sulfadiazine level was 3.8 mg. per 100 cc.

Bronchoscopy on the eighth day showed marked spasm of the vocal cords. The trachea was narrowed in the anteroposterior direction. The carina was thickened and shortened in the anteroposterior diameter, giving it a twisted rope-like appearance. The right bronchus was also narrowed in the anteroposterior diameter and had a similar appearance, which was thought to be due to spasm. On the medial wall of the right main bronchus close to the carina there was a thickening of the bronchial wall that bled easily. A biopsy was attempted but no tissue could be obtained. The left main bronchus had much the same narrowed spastic appearance as the right.

Following bronchoscopy the patient became slightly more dyspneic and cyanotic. Bronchography had to be omitted. She was given 10 cc. of aminophyllin with temporary relief. In the next twenty-four hours she experienced considerable respiratory distress and raised large amounts of blood-tinged, frothy sputum. The respirations were 36, the pulse 140, and the blood pressure 140 systolic, 90 diastolic. On the ninth day coarse rattles were heard over the left chest and the patient was pale, sweaty and cold. The administration of aminophyllin was ineffective, and oxygen gave only temporary relief. She became progressively more dyspneic and died suddenly on the tenth hospital day.

Differential Diagnosis

Dr. Paul C. Zamecnik: The first problem to decide in reaching a diagnosis in this case is whether the disease involving the bronchial tree was intrinsic or extrinsic in origin. Since both the right and left main stem bronchi presented the same narrowed, spastic appearance, and inasmuch as both sides of the chest showed diffuse haziness by x-ray,—even though it was more marked in the right chest,—the evidence points toward intrinsic disease of the bronchi and bronchioles.

An extrinsic mediastinal mass would, in general, be more likely to produce bronchial stenosis unilaterally rather than bilaterally. It is true that lymphomatous mediastinal nodes can produce bronchial obstruction of both sides of the chest, but lymphomatous masses of this magnitude are usually visible by x-ray, and in this case no mediastinal enlargement is reported. Such additional possibilities as a dermoid cyst, a neurofibroma, a substernal thyroid gland, and an enlarged thymus fall into this category and therefore have no positive evidence to support them. In connection with the possibility of aortic aneurysm, the x-ray definition of the aorta with its tortuosity and calcification seems sufficiently clear to make this diagnosis unlikely. Furthermore, the aortic second sound was presumably intact, and the Hinton reaction negative.

A discussion of intrinsic diseases involving the bronchial tree may properly be introduced by a consideration of bronchial asthma and bronchiogenic carcinoma. Against the diagnosis of bronchial asthma are the age of the patient at the onset of the disease, the lack of a previous history of asthmatic attacks, the failure of response to epinephrin, and the rapid, downhill progress of the disease. The spasm of the bronchi and the bronchiectasis, however, fit in well with this diagnosis. It is impossible to rule out bronchiogenic carcinoma, but the bilateral character of the disease and the absence of visible neoplasm by bronchoscopy rob this diagnosis of its chief support.

If this line of reasoning is correct, one is left with certain rarer diseases involving the trachea, bronchi and bronchioles. Scleroma is usually a more chronic type of disease than the one here presented, starting with a falling in and a fibrous-tissue replacement of the cartilaginous framework of the nose and throat; then the glottis and trachea are involved and the process extends downward in the respiratory tract. There is no such antecedent history in this case, and indeed the history suggests that the difficulty progressed upward from the lower part of the respiratory tract.

Most of the data are consistent with a disease in which connective tissue grows in from the walls of the terminal and even the larger bronchi, with a resultant partial or complete occlusion of their lumens. Such a condition occasionally follows pneumonia or acute bronchitis, and is characterized by a progressively downhill course, with dyspnea, orthopnea, cough and fatal termination. In most cases of bronchiolitis fibrosa obliterans, miliary nodules resembling those of tuberculosis are seen in the lung fields by x-ray, but in the present case no mention of such findings is made. In spite of the absence of this valuable sign, I find myself forced to make this diagnosis. The initial chest pain may be attributed to pleural adhesions accompanying the pneumonia, and the remainder of the picture appears to have been due to obliterative bronchiolitis and bronchitis, with bronchiectasis.

Clinical Diagnosis

Bronchial asthma.

Dr. Zamecnik's Diagnosis

Bronchiolitis fibrosa obliterans.

Anatomical Diagnosis

Carcinoma of pancreas, with metastases to lungs, pleura and bronchial, mediastinal and retroperitoneal lymph nodes.

Pathological Discussion

Dr. Benjamin Castleman: This case is another example of Dr. Rackemann's frequent statement "All is not allergy that wheezes," and Dr. Zamecnik wisely discarded the diagnosis of bronchial asthma, although that was the ante-mortem diagnosis. There was disease of the bronchial tree, but it was primarily extrinsic. The autopsy showed diffuse carcinomatosis of both lungs, and microscopically the tumor cells involved the lymphatics, especially in the peribronchial and peribronchiolar lymphatics. In some places tumor cells had extended through the bronchiolar walls and had invaded the mucosa. We were unable, however, to find any gross evidence of a tumor that involved the lumen of a bronchus, and we did not believe that the primary tumor was in the lung. We found metastases in the bronchial and retroperitoneal lymph nodes and finally discovered the primary tumor in the body of the pancreas.

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The Journal does not hold itself responsible for statements made by any contributor.

Communications should be addressed to the *New England Journal of Medicine*, 8 Fenway, Boston 15, Massachusetts.

MUTATIS MUTANDIS

Change begets change. Not so long ago it was generally accepted that unconsciousness following a blow on the head — concussion — and the more serious pathologic changes often associated with it were the direct result of the local application of force. This did not explain, however, the damage to the brain opposite the point struck. Because this damage was usually severer than that occurring immediately beneath the point of contact it could not be ignored, and the theory of contracoup was evolved to explain its presence. It was conceded that acceleration or deceleration of the head was necessary to produce the contracoup effect but did not necessarily cause unconsciousness. More recent work done with greater exactness under experimental conditions has also included acceleration or deceleration of the head as a prerequisite of unconsciousness. As a corollary to this point of view the failure to lose consciousness following perforating wounds of the skull, wounds made by multiple small missiles with low velocity or a crush of the head was alleged to be traceable to an absence of acceleration or deceleration of the skull and its contents. These conclusions have been rather widely accepted, and they have been regarded as a satisfactory and probably a final explanation of the mechanism of concussion and its associated brain pathology.

Now comes a physicist, a Doctor of Philosophy from Oxford and the holder of an M.A. degree from Edinburgh, who, working as a research physicist in the Laboratory of Physiology and the Department of Surgery at Oxford, propounds a new explanation for the development of unconsciousness and the causation of all degrees of brain injury.* In the course of his paper he claims that neither the contracoup nor the acceleration-deceleration effect is adequate as explanation for such results. He states that the most important physical properties of the brain are its comparatively uniform density, its extreme incompressibility, the small resistance it offers to change in shape as compared with that which it offers to change in size (the effect of pressure by a retractor as compared with that of an estimated pressure of 10,000 tons), and the lesser rigidity of the brain as compared with that of the skull — 1 ton being required to reduce the diameter of the skull by 1 cm. Furthermore, he asserts that the shapes of the skull and brain determine the location of the injuries. He also points out that if one grants that the brain behaves like similar substances whose physical properties have been studied to date, its constituent particles are pulled so far apart as the result of a blow that they do not join up again properly when the immediate effect of the blow is over. The amount of this pulling apart is proportional to shear strain or rotational effect, and not to the amount of compression that occurs.

In conformity with this conception and working with a model constructed of materials that are claimed to react to blows in the same way that the skull and brain do, the author claims to have demonstrated that the localized damage in craniocerebral injuries is traceable to skull distortion.

*Holbourn, A. H. S. Mechanics of head injuries. *Lancet* 2:438-441 1943.

Distant damage, on the other hand, occurs in regions where the brain is locally fixed in relation to the skull. Adjacent cerebral tissue is thus permitted to rotate around such fixed points and to set up shear strains, which eventuate in the pathologic changes recognized as concussion, contusion and laceration. Extradural hemorrhages are said to be caused by skull distortion, whereas subdural and subarachnoid hemorrhages result either from this same cause or from shearing damage to appropriate blood vessels.

To produce shear strains, therefore, the skull and its contents must not only be struck but must also be rotated. Because of its shape the liability of compression without rotation of the skull and its contents following a blow is extremely small. On the theoretical concept that concussion with its unconsciousness is caused by separation of constituent particles to a minimal degree, in contradistinction to a laceration, when such separation is maximal, the author predicts, "The theory of head injury can be developed on the assumption that during and immediately after the blow, all factors other than the purely physical can be neglected." This includes so-called "contracoup damage." If further investigations support his demonstration, then, as he says, "One can be reasonably confident that only minor modification to the theory will be necessary to explain quantitatively the usual type of accident" — at least until another worker presents a new concept and a different explanation.

A NEW TEST FOR ACUTE BACTERIAL INFECTION

THREE chemical constituents of pneumococci are well known: the type-specific polysaccharides, the species-specific protein and a nonspecific carbohydrate. The last is apparently common to many bacteria, and recent work has shown that a protein substance reacting with this nonspecific carbohydrate is present in human serum during the acute phase of many bacterial infections but is not found after recovery, nor is it present in the serum of normal individuals. Skin tests with the type-specific polysaccharide have had a limited use, especially before the introduction of chemotherapy, both as an aid in prognosis and as a guide to therapy with antipneumococcus serum. Satisfactory preparations of both the specific and nonspecific carbohydrates are difficult to make, and skin reactions with these substances, as with other materials, have many drawbacks.

Löfström* in a monograph just published in Sweden describes in detail a nonspecific reaction that involves the capsular swelling of pneumococci of certain types in human serum. The Type 27 pneumococcus has proved to be most satisfactory for this purpose. The reaction is carried out in exactly the same manner as the Neufeld test for the typing of pneumococci. In the latter test the pneumococcus in question shows swelling of the capsule when it is mixed with antipneumococcus rabbit serum of the homologous type. Löfström's reaction takes place with the Type 27 pneumococcus (and to only slightly less extent with Types 16 and 28) and human serums from a large variety of conditions. The author has worked out many of the physical and chemical characteristics of the serum responsible for this reaction and has applied it to the study of serums from a variety of conditions.

A number of important practical applications of this nonspecific reaction are claimed by the author. It does not occur in the serum of normal individuals but is present only during the febrile stage of bacterial infections and in some other febrile conditions associated with tissue breakdown. It cannot be demonstrated in the virus diseases that he has studied. Thus the reaction is negative with serums from patients with common colds or influenza, but becomes positive if bacterial complications intervene. The reaction occurs during acute bacterial infections of the respiratory tract, such as tonsillitis, sinusitis and pneumonia, but promptly disappears from the serum after the acute infection subsides. It is therefore offered as an aid in prognosticating the occurrence of bacterial complications of virus infections or other conditions. In cases of meningitis in which cultures are negative the test may be used to differentiate bacterial from virus infections — it is positive in all the acute bacterial meningitides, weakly positive in tuberculous meningitis and negative in lymphocytic choriomeningitis and the virus encephalitides.

The author also claims that this reaction can be used to differentiate cases of coronary occlusion

*Löfström, G. Non-specific capsular swelling in pneumococci: a serologic and clinical study. 98 pp. Stockholm: P. A. Norstedt & Söner, 1943. Preliminary studies appeared in the following article: Löfström, G. Serologiska studier vid akuta pneumonier. *Nordisk Med.* 3 (Hygeia 105): 1927-1932, 1939.

from congestive failure without occlusion, since it is present only during the phase of coronary occlusion when tissue breakdown is taking place. Likewise he believes that the reaction may differentiate chronic endocarditis with valvular defects and subacute bacterial endocarditis, the capsular swelling being demonstrated in the latter but not in the former.

As a routine method for the clinic, the test for nonspecific capsular swelling has the great advantage that it is simple to perform and easy to evaluate. Should the author's claims be substantiated, the reaction may prove to be an extremely useful tool.

MEDICAL EPONYM

Riedel's Struma

Professor Bernhard Moritz Karl Ludwig Riedel (1846–1916), of Jena, discussed the topic "Die chronische, zur Bildung eisenharter Tumoren führende Entzündung der Schilddrüse [Chronic Inflammation of the Thyroid Gland Leading to the Formation of Iron-hard Tumors]" at the twenty-fifth congress of the Deutsche Gesellschaft für Chirurgie, on May 30, 1896. His remarks are published in *Verhandlungen der deutschen Gesellschaft für Chirurgie* (1:101-105, 1896). A portion of the translation follows:

> I present for your consideration a new, unusual property of the thyroid gland. . . .
>
> There came under my care a forty-two-year-old man who for six months had noticed an increase in size of his thyroid gland, together with moderately severe dyspnea. There was a bilateral tumor, not very large, but extraordinarily hard and immovable. I supposed it to be a malignant goiter, and on November 30, 1883, attempted operation, exposed the tumor and saw at once that it was very firmly adherent to the carotid artery and the internal jugular vein on either side, resected a portion of the internal jugular, then after removal of a bit of the goiter about as large as a walnut, cut short the operation, since I was forced to consider the case inoperable. . . . Half a year later the man reported that he was entirely well and able to work. In the meantime we had studied the specimen and found in it no trace of any new-growth. It was an inflammatory process; infiltration with round cells was demonstrated; carcinoma and sarcoma were ruled out, and the patient had neither tuberculosis nor syphilis. . . .
>
> Twelve years later a second case was encountered.
>
> Inspection of the preparation gives no hint of the hardness of the growth; one would expect firm, fibrous tissue as a constituent of the tumor, but we see only masses of round cells, as described.
>
> The growth seems even harder before operation: this is explained by the abundant firm adhesions of the tumor to the surrounding soft parts, especially with the blood vessels, nerves and trachea. . . .
>
> It would seem . . . as though for the present only partial excision of the growth exerts an influence on the inflammatory process.

R. W. B.

MASSACHUSETTS MEDICAL SOCIETY

EXECUTIVE COMMITTEE OF THE COUNCIL

On December 29, 1943, the Executive Committee of the Council, on the recommendation of the Committee on Membership and representatives from the supervising censors, took the following action:

Accepted the resignations of the following named fellows, under the provisions of Chapter I, Section 7, of the by-laws, these resignations to be effective as of January 1, 1944:

Medinger, Fred G. (nonresident), 326 South 19th Street, Philadelphia.

Strong, Seth L. (Plymouth), Marshfield Hills.

Reinstated the following named fellow, who had resigned from the Society while in good standing, under the provisions of Chapter I, Section 10, of the by-laws:

Houghton, Henry L. (Suffolk), 176 Commonwealth Avenue, Boston.

Allowed the following named fellow to change his membership from one district society to another, without change of legal residence, under the provisions of Chapter III, Section 3, of the by-laws:

Simmons, Fred A., 264 Beacon Street, Boston (Norfolk to Suffolk).

Remitted the dues, including those of 1941, 1942 and 1943, of the following named fellow who is ill and incapacitated, under the provisions of Chapter I, Section 6, of the by-laws:

Jones, Raymond C. (Worcester North), Ashby.

Reinstated following named fellows, under the provisions of Chapter I, Section 10, of the by-laws, who had been deprived of membership for the nonpayment of dues, provided their arrears in dues at the time they were dropped plus the dues for 1944 be paid to the treasurer of the Society:

Karlsberg, Isador J. (Middlesex South), 164 Main Street, Hudson. Joined 1932. Deprived 1939.

Parris, Roland O. (Barnstable), 18 Locust Street, Falmouth. Joined 1916. Deprived 1934.

Rifkin, A. (Plymouth), 197 Main Street, Brockton. Joined 1929. Deprived 1938.

The personnel of the Committee on Membership is as follows: Harlan F. Newton, *chairman*; John E. Fish; Peirce H. Leavitt; A. William Reggio; and Sumner H. Remick. The representatives of the supervising censors are as follows: William H. Allen; H. Quimby Gallupe; and Albert E. Parkhurst.

Michael A. Tighe, M.D., *Secretary*
Executive Committee

SECRETARY'S OFFICE

I believe that the following letter, recently received from Dr. Victor Johnson, secretary of the Council on Medical Education and Hospitals of the

American Medical Association, will be of interest to the members of the Society.

MICHAEL A. TIGHE, *Secretary*

December 23, 1943

Dr. Michael A. Tighe, Secretary
Massachusetts Medical Society
8 The Fenway
Boston, Massachusetts

Dear Doctor Tighe:

In the November 25 issue of the *New England Journal of Medicine* there appears, on pages 832, 833 and 834, a discussion of the relationships of the Society with the College of Medicine of Middlesex University. The letter from Dr. Stephen Rushmore is quoted in which the following statement is made:

> There has been expressed a fear that hospitals approved by the Council on Medical Education of the American Medical Association would lose their standing with this body if they permitted the use of their clinical facilities for the teaching of the students of Middlesex. The secretary of the council, Dr. Herman G. Weiskotten, has stated explicitly that as far as the rating by the council is concerned, such teaching of students would have no effect. Thus this difficulty has now been removed.

It occurs to me that you might be interested in knowing the exact policy adopted by the Council on Medical Education and Hospitals of the American Medical Association with regard to students from schools not on its approved list being accepted by approved hospitals for clinical instruction. The policy of the Council is embodied in the following statement:

> The interest of the Council on Medical Education and Hospitals of the American Medical Association in hospitals approved for the training of interns and residents is primarily in the maintenance of a satisfactory educational program for the training of house officers. In the case of hospitals which in addition to internships and residencies also offer training to undergraduate medical students, the Council is also interested in the maintenance of satisfactory standards of undergraduate instruction. Therefore, it is not within the scope of the Council's activities to decide whether any hospital should or should not accept students as clinical clerks from any one or more than one medical school, provided such acceptance does not reduce the quality of instruction offered by the hospital either (a) to house officers, or (b) to such undergraduate medical students as may already be receiving instruction in the hospital in instances where the hospital contemplates acceptance of students from more than one medical school.

Yours sincerely,

[Signed] Victor Johnson

VICTOR JOHNSON, M.D., *Secretary*

DEATHS

FLANAGAN — James E. Flanagan, M.D., of West Roxbury, has been reported missing as a result of the sinking of the destroyer *Turner*.

Dr. Flanagan received his degree from Tufts College Medical School in 1938. He had been practicing medicine about four years when he entered the Navy a year ago. He held the rank of lieutenant at the time of his death. He was a member of the Massachusetts Medical Society and the American Medical Association.

KERRIGAN — John J. Kerrigan, M.D., of Fall River, died January 6. He was in his sixty-sixth year.

Dr. Kerrigan received his degree from the College of Physicians and Surgeons, Baltimore, in 1906, and did postgraduate work abroad. For many years he was on the staff of the Massachusetts Eye and Ear Infirmary. He was a member of the Massachusetts Medical Society and the American Medical Association.

His widow, a son and a daughter survive.

MASSACHUSETTS DEPARTMENT OF PUBLIC HEALTH

NEW LAW REGARDING PROPHYLACTIC TREATMENT OF EYES OF INFANTS

Attention is directed to amended Chapter 111, Section 109*A*, of the General Laws, which requires physicians to record on the birth certificate the prophylactic treatment of the eyes of the newly delivered child. This amendment became effective on June 2, 1943. Prior to that date the law required only that the physician or hospital officer treat the eyes of the newborn within two hours after birth with a department-approved prophylactic. The present law reads as follows:

> The physician, or hospital medical officer registered under section nine of chapter one hundred and twelve, if any, personally attending the birth of a child shall treat his eyes within two hours after birth with a prophylactic remedy furnished or approved by the department, and he shall record on the birth certificate the use of such prophylactic. Whoever violates this section shall be punished by a fine of not more than one hundred dollars.

It is suggested that physicians use the left margin of the certificate to record the prophylactic used.

COMMUNICABLE DISEASES IN MASSACHUSETTS FOR DECEMBER, 1943

RÉSUMÉ

DISEASES	DECEMBER 1943	DECEMBER 1942	SEVEN-YEAR MEDIAN
Anterior poliomyelitis	15	2	1
Chicken pox	1616	1444	1511
Diphtheria	44	12	18
Dog bite	431	505	561
Dysentery, bacillary	30	6	16
German measles	118	190	63
Gonorrhea	477	286	335
Measles	1319	1871	1082
Meningitis, meningococcal	65	27	7
Meningitis, other forms	16	10	*
Meningitis, undetermined	4	0	*
Mumps	671	1080	597
Pneumonia, lobar	576	327	407
Salmonella infections	4	7	4
Scarlet fever	978	1307	753
Syphilis	560	489	444
Tuberculosis, pulmonary	214	239	241
Tuberculosis, other forms	18	13	26
Typhoid fever	2	4	5
Undulant fever	3	2	3
Whooping cough	343	1171	828

*Pfeiffer-bacillus meningitis only other form reportable previous to 1941.

COMMENTS

Anterior poliomyelitis has shown the usual seasonal decline since the peak of 121 cases in September, but nonetheless the December level was fifteen times the seven-year median. Diphtheria, on the other hand, has been showing a steady rise since September, reaching a point nearly two and a half times the seven-year median. The December prevalence has not been as high since 1935. The number of cases of lobar pneumonia was also high compared to that reported in December in recent years.

GEOGRAPHICAL DISTRIBUTION OF CERTAIN DISEASES

Anterior poliomyelitis was reported from: Boston, 1; Fall River, 1; Haverhill, 2; Lynn, 1; Newton, 2; North Adams, 1; Norwood, 1; Peabody, 1; South Hadley, 1; Waltham, 3; Winchester, 1; total, 15.

Anthrax was reported from: Salem, 1; total, 1.

Diphtheria was reported from: Amesbury, 1; Barre, 1; Bedford, 1; Boston, 16; Cambridge, 1; Hopedale, 1; Medford, 1; Melrose, 1; New Bedford, 1; Salem, 1; Saugus, 1; Somerville, 11; Taunton, 6; Watertown, 1; total, 44.

Dysentery, bacillary, was reported from: Adams, 1; Boston, 5; Cambridge, 1; Haverhill, 4; Lowell, 1; Worcester, 18; total, 30.

Encephalitis, infectious, was reported from: East Longmeadow, 1; Holyoke, 1; Lowell, 1; Springfield, 1; Worcester, 1; total, 5.

Malaria was reported from: Fort Devens, 8; Haverhill, 1; Worcester, 2; total, 11.

Meningitis, meningococcal, was reported from: Barnstable, 1; Boston, 25; Bourne, 1; Cambridge, 2; Camp Edwards, 4; Canton, 1; Chelsea Naval Hospital, 1; Cohasset, 1; Danvers, 1; Dedham, 1; Everett, 2; Fairhaven, 1; Fall River, 1; Fort Devens, 2; Framingham, 1; Gloucester, 1; Greenfield, 1; Hingham, 1; Holyoke, 1; Lawrence, 1; Lowell, 1; Milton, 1;

New Bedford, 1; North Adams, 1; Plymouth, 2; Salem, 2; Springfield, 3; Westwood, 1; Weymouth, 1; Winthrop, 1; Worcester, 1; total, 65.

Meningitis, Pfeiffer-bacillus, was reported from: Boston, 1; Lynn, 1; Springfield, 2; total, 4.

Meningitis, pneumococcal, was reported from: Fall River, 1; Marblehead, 1; Medford, 1; Oxford, 1; Worcester, 1; total, 5.

Meningitis, staphlococcal, was reported from: Fall River, 1; total, 1.

Meningitis, streptococcal, was reported from: Marlboro, 1; Springfield, 1; total, 2.

Meningitis, other forms, was reported from: Boston, 3; Methuen, 1; total, 4.

Meningitis, undetermined, was reported from: Arlington, 1; Fort Devens, 1; Springfield, 1; Worcester, 1; total, 4.

Salmonella infections were reported from: Andover, 1; Boston, 1; Haverhill, 1; Northfield, 1; total, 4.

Septic sore throat was reported from: Amesbury, 1; Boston, 13; Cambridge, 1; Lawrence, 2; Medford, 1; Milton, 1; total, 19.

Tetanus was reported from: Fall River, 1; Raynham, 1; total, 2.

Trachoma was reported from: Medway, 1; total, 1.

Typhoid fever was reported from: Boston, 1; Medford, 1; total, 2.

Undulant fever was reported from: Adams, 1; Great Barrington, 1; Hatfield, 1; total, 3.

CORRESPONDENCE

WAGNER–MURRAY–DINGELL BILL

To the Editor: It did not seem to me quite fair that the letter under date of December 2, 1943, signed by the president and secretary of the Massachusetts Medical Society should have been sent to our representatives in Congress, because as I read the letter it implies that the Society has already expressed an opinion on the subject matter involved. This I am informed is not the case.

I know an appreciable number of members of the Society who do not believe in the sentiments expressed in this letter, and therefore, irrespective of what the Council will decide in February, it seems to me only fair to inform the members from Massachusetts in Congress that a minority at least of the Massachusetts Medical Society have a different point of view. I am, therefore, sending to the Massachusetts representatives in Congress a letter, a copy of which I am enclosing.

I have always hoped that the *Journal* would be willing to present both sides of a controversial matter, so I hope that you will be willing to publish this letter with the enclosure.

CHANNING FROTHINGHAM, M.D.

1153 Centre Street
Jamaica Plain, Massachusetts

* * *

January 12, 1944

Dear Sir:

In the December 2, 1943, issue of the *New England Journal of Medicine*, on page 884, there appears a letter signed by the President and Secretary of the Massachusetts Medical Society which was sent to Massachusetts members of the Senate and the House of Representatives in Congress. This letter gives the impression that the statements expressed therein are the sentiments of the Massachusetts Medical Society. Up to the present time neither the Society nor its Council, which often expresses opinions for the Society, has taken any formal action on the merits of the Wagner–Murray–Dingell Bill. What the action of the Council of the Massachusetts Medical Society or the Society itself will eventually be in regard to the Wagner–Murray–Dingell Bill remains for the future to decide. In the meantime I would like to call your attention to the fact that there are many members of the Massachusetts Medical Society who are not in sympathy with the statements expressed in this letter of December 2, 1943, referred to above and who believe that there is a possibility to accomplish a tremendous improvement in the delivery of medical care to the citizens of Massachusetts by developing a program along the general lines outlined in the Wagner–Murray–Dingell Bill.

A group of doctors with whom I am connected has made a careful study of the medical aspects of Senate Bill 1161 and has offered constructive criticism in regard to the Bill. I am enclosing a copy of the statement of this group thinking that it might be of interest to you.

Sincerely yours,

CHANNING FROTHINGHAM, M.D.
President of the Massachusetts Medical Society (1937–1939)

BOOK REVIEWS

Doctors Aweigh: The story of the United States Navy Medical Corps in action. By Rear Admiral Charles M. Oman (MC), U. S. N. 8°, cloth, 231 pp., with 10 illustrations. Garden City, New York: Doubleday, Doran and Company, Incorporated, 1943. $2.50.

The subtitle gives the key to this clear-cut, well-written story of forty years' experience in the United States Navy. The author has seen plenty of action, and he knows how to report it. Here is the story of the preparedness and efficiency of the Navy Medical Corps at Pearl Harbor on that peaceful, sunny morning of December 7, 1941, which will thrill and please any doctor. Again one may read of the astounding adventures of Dr. Wassell and of Dr. White on the *Lexington* and the story of the brilliant appendectomy performed by Pharmacist's Mate Lipes while the submarine to which he was attached rested on the bottom of the Pacific. These and many other tales, along with good advice, make sound reading and leave one proud and grateful for the high standards of the United States Navy and the splendid men who maintain them.

Pictorial Handbook of Fracture Treatment. By Edward L. Compere, M.D., and Sam W. Banks, M.D. 8°, cloth, 351 pp., with 171 illustrations. Chicago: The Year Book Publishers, Incorporated, 1943. $4.25.

Recent advances in the management of fractures have resulted in the introduction of so many new methods that the general practitioner, who in most cases must be the one to institute the first treatment to which a fracture victim is subjected, should be acquainted with those procedures that have been shown to have been attended with the most gratifying results.

This small volume of Compere and Banks presents in a compact and well-illustrated text a discussion of the essentials for diagnosis and treatment. The basic facts concerning repair in bone, — based on knowledge of the pathology of fractures, — the rate of healing, and causes of delayed and nonunion, together with a clear presentation of methods of reduction, the principles of aftercare and the complications that sometimes follow, are included in the first part of the book. The four remaining sections are devoted to the upper and lower extremities, the trunk, the face and the skull. Dislocations are also included. Many line drawings and photographs of x-ray films are used to illustrate the various types of fracture and their reduction and fixation by measures that have proved satisfactory.

Both the authors and publishers have acquitted themselves most creditably, and the practicing physicians have at their service a most helpful guide to their efforts.

Diseases and Injuries of the Larynx: A textbook for students and practitioners. By Chevalier Jackson, M.D., Sc.D., LL.D., and Chevalier L. Jackson, M.D., M. Sc. Second edition. 8°, cloth, 633 pp., with 197 illustrations. New York: The Macmillan Company, 1942. $8.00.

This is a new edition of a textbook that has become a classic in the short time since the appearance of the original edition in 1937. Surgeons within and outside the specialty are by now familiar with it, and many general practitioners have found it to be their best adviser in borderline cases. The style is most vivid and personal, and when reading the book, one is subject to the sensation of being present at one of the widely known courses of the authors.

There are 11 color plates, more than 100 halftones and 221 pen and pencil drawings to clarify the clinical picture. The new chapter on war surgery is an important and timely addition. Incidence, etiology, special pathology and accessory injuries in war are discussed, together with their peculiar symptoms and the treatment and prognosis; next, the authors consider organization for care of the wounded, chemical warfare by asphyxiating, irritating and poisonous gases and smoke and, finally, the psychical laryngeal traumas of war.

In its new form, the textbook will without doubt continue to speak *viva voce* to any member of the profession who turns to it with his medical or surgical problems regarding the larynx.

(*Notices on page xiii*)